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New Advertisements.

In the growth of THE ELECTRICAL WORLD in circulation, size and general improvement, the value of its columns for reaching those engaged in electrical pursuits or interested in electrical matters has not failed to be appreciated by advertisers. Readers will find it to their advantage to keep their eyes on the advertising as well as the reading columns. The following are the new advertisements in this issue:

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Vol. VIII. NEW YORK, NOV. 6, 1886. No. 19.

LIBERTY is now enlightening the world, and she does it, too, with an electric torch.

THE Supreme Court of the United States is not to be envied its task of digging through fifty cubic feet of "record" in the telephonic litigation that has now reached it. Much of the record is repetition, but there will be enough left, after all the sifting, to make the judges weary. The voluminous nature of the papers is some indication of the magnitude of the interests at stake.

AN interesting summary, or historical review, of what has been done to establish the ohm as a standard of resistance is contributed to our columns this week by Mr. F. W. Jones, the able manager of the United Lines. Mr. Jones thought that it might be well to have the various stages given sequentially, and his narrative covers a great many years, as well as the work of many investigators in different countries.

THE electro-magnet plays such an important part in electro-technics that a method of maintaining its action constant with change of resistance in its wire caused by change of temperature is an interesting addition to the methods of magnet regulation. Prof. Thomson has applied the method to the shunt magnet in an arc lamp, but it may also be applied in other situations where constancy of action is desirable.

BEFORE the work is ended, the electrical subways of New York will probably present a great variety of materials and methods, efficient, perhaps, in most instances, but wanting the uniformity of a general system. We do not know that this diversity is altogether to be regretted. It ought to advance the knowledge of the subject, in which so many problems are still unsolved, and it may relieve the Subway Commission of attack and suspicion on the part of those whose systems would otherwise go untried.

AT last the large telegraph and telephone companies have secured some sort of control of the company intrusted with the work of providing New York with electrical subways. This need not be a matter of surprise, nor perhaps need it be the subject of much worry. The work would be intolerably delayed by the opposition of those whose wires are to occupy the conduits, and, under the care of an honest commission, it can be greatly expedited by their active concurrence.

ONE of the most notable of the electric railways in Europe is that at Portrush, Ireland, operated by water power. We now have something of the kind in this country at Appleton, Wis., where Mr. Van Depoele has started another of his roads, it being dependent on a never-failing water supply in the neighborhood. Our illustrated article on the subject in this issue ought to be suggestive to many readers of the way in which they can utilize water-power now going to waste around them.

IT is evident, from the opinions expressed in many quarters, that electricians in New York do not generally approve of the methods adopted for lighting the Statue of Liberty. To get 40,000 or 50,000 candle-power, and then to box it up in a little iron room, through whose windows it will be seen but dimly, is certainly hiding one's light under a bushel. What is the object of having so much light unless it is to be used in illumination? If the Light-house Board still objects to the employment of the statue as a beacon, let us have more light thrown upon the statue itself—from the base upward. The effect will be good, and Liberty's light should, if symbolism is to be studied, be diffused rather than concentrated. At present the pedestal is brilliantly lighted, but the statue above stands half in darkness.

IN the application of the peculiar devices embodied in his telephone repeater, described on another page, Mr. Moses G. Farmer shows that a series of small armatures in co-operation have a large mobility and positiveness of action with the minimum of inertia, and hence are better for certain purposes than a single armature. The case seems to be quite analogous to that in which the cores of induction coils are built up of iron wires instead of being solid, with the object of obtaining the well-known quickness of action in magnetizing and demagnetizing. The difference in the present case consists in dividing the core transversely into sections instead of longitudinally in the shape of wire. It is true that the sections are movable, and made so for a purpose, but the delicacy of action claimed for them is no doubt due to the subdivision.

THANKS to the numerous systems of electric railways which are rapidly being developed in this country, the time cannot be far distant when the employment of electricity in the realm of locomotion will become general. The special problems of electric railroading have probably more than any others brought out the latent energies of inventors, for in this case we have to consider not the motor alone but its connection with the surroundings as well. Our article in another column describing Mr. Stephen D. Field's electric railway system shows that new forms are being applied, or rather old forms are being employed to suit present purposes. The method of driving by means of the parallel rod connected directly to the armature shaft, while novel in its application to electric locomotives, will be recognized as the usual type of driving mechanism in steam locomotives. Regarding the electrical details, a decided novelty is introduced in the manner proposed for maintaining the brushes at the non-sparking points. By the use of an auxiliary pair of brushes bearing at the neutral points and in connection with a motor, every change is felt by the regulating mechanism which acts to correct the] abnormal conditions. Mr. Field, it will be noticed, proposes to operate on the elevated railways of this city using an E. M. F. of 600 volts and over. He has also under elaboration the project of a fast suburban electric railway, which shall afford rapid communication between New York and its outlying districts, towards which the eyes of so many who long for homes of their own are now turned eagerly.

THE friendly interest which gas companies all over the country are manifesting in electric lighting is a remarkable instance of the change brought about by a few years' study of the capabilities of the electric light. At the very first, it was pointed out by some that gas companies need not fear the electric light as a competitor since their products could be used in the gas engines employed to drive the dynamos. And it is true that in quite a number of instances, especially abroad, electric light installations employing gas engines are in operation. As the cost of gas to the consumer in this country is too great as compared with the cost of power derived from coal and steam, large gas-engine plants are not known. But as exemplified in another column, there seems to be no good reason why the gas companies themselves should not employ their own product as fuel for gas engines with which to drive dynamos furnishing current for electric lighting. With the improved methods of gas-making now employed, and by manufacturing a cheap gas specially for the purpose, which need not have illuminating power, it seems highly probable that success could be obtained. In the case of the city of Prague, the street lighting has been economically accomplished in this manner, and other foreign towns, we understand, are about to follow the example thus set them. With the acknowledged superior theoretical efficiency of the gas engine and with cheap gas, the gas companies consuming their own product might yet find a solution of the problem involved in generating electricity cheaply.

AN important meeting of incandescent lamp manufacturers has been held in London for the purpose of considering what should be done to prevent the Edison-Swan Company from enjoying a "monopoly" of the business under the recent decision made in its favor by the courts. The attendance was eminently representative. One interesting point brought out was that in Germany the electrical trade was already organizing to resist a like attempted "monopoly" there. In regard to the present position of affairs in England, Mr. F. L. Rawson said: "The plaintiffs attacked us on the Edison patents and also on the Swan patents. By many people it was thought that the Swan and Gimingham patents, originally the property of the Swan Company, were quite as strong as the Edison patents. These two Swan patents we broke down completely, and out of the four claims of the Edison patent there was only one claim on which we were defeated. The second patent that was upheld was the Cheesbrough. This patent had originally 30 claims being drawn up on the usual American system of making as many claims as possible, in the hope that some one of these may give the patentee a chance of blackmailing successors who may have the expense and trouble of working out the details foreshadowed in the claims. Nearly the whole of this patent, together with 27 out of the 30 claims, was disclaimed, and, owing to the inherent difficulties of understanding the case, the patent was upheld notwithstanding our having so distinctly proved our case out of the mouths of the plaintiffs' witnesses that we did not consider it necessary to call our own witnesses. With regard to this action, I feel sure that on the evidence already given if we can get the Appeal Judges to thoroughly understand the case we shall win. With regard to the Edison patent, should even Mr. Justice Butt's decision be upheld, which we are advised by our counsel, including the late Solicitor-General, Sir Horace Davey—whose opinion stands as high as, if not higher, than any counsel in patent cases—is not likely to be the case in either of the actions, the Appeal Court will have to state the point at which low-resistance lamps end and high-resistance lamps begin. If they take the same view of the case as Mr. Justice Butt, the patent will give no monopoly, for, according to Mr. Justice Butt's opinion, although he would not lay it down as law, but left it to the Appeal Court, we can make lamps up to 100 ohms without infringing Edison's patent; this will allow us to make lamps up to 60 volts, which will be quite enough for most practical purposes. If, however, the appeal is dropped, the decision stands good against lamps of any resistance." We must say we hardly see the force of the criticism here on the American patent system as a whole. No man can be fairly blamed for making his claims as strong and as comprehensive as the Patent Office will allow. But that is a side issue. The result of the meeting was that Mr. Rawson has been authorized to form a committee which should proceed at once to carry the case up on appeal. The expense of the appeal is estimated at about $12,500, and the temper of those concerned gives promise that there will be no great difficulty in raising the amount. The question is really a vital one if there is to be competition in incandescent lighting in England, and it bears directly on the condition of affairs in this country, where testimony is, we believe, being taken in suits brought to determine the validity of like basic patents.

REVIEWS OF NEW BOOKS.

ELEKTRICITAT UND MAGNETISMUS IM ALTERTHUME. By Dr. Alfred Ritter von Urbanitzky. Vienna: A. Hartleben. 1887. 284 pp.

The history of a science is frequently as interesting to many as the study of it, and the development of electricity and magnetism presents quite a large field for historical research. Dr Urbanitzky has evidently sifted Greek and Latin literature for grains, while the Chinese is not unfrequently given as the source of items of information. The book, as its title indicates, is an account of what the ancients knew regarding electricity and magnetism, and as such presents an interesting record of many quaint and curious beliefs regarding their nature. A similar work, written 2,000 years hence, will probably serve to amuse the world then with its account of some of the ideas prevalent to-day.

DIE LABORATORIEN DER ELEKTRO-TECHNIK UND DEREN NEUERE HILFSAPPARATE. By August Neumayer. Vienna: A. Hartleben. 1887. 226 pp.

In view of the increasing number of establishments undertaking electrical work of various descriptions, the appearance of a book describing the manner of arranging a testing laboratory is eminently timely. The author has sought in this volume, No. XXIII. of the "Elektro-technische Bibliothek," to give a complete account of the numerous instruments necessary for the equipment of a laboratory. He has, however, not confined himself to the mere description and application, but has undertaken to point out the proper method of disposing the instruments with relation to one another, so that they shall be convenient for use, and so that a test or observation shall occupy the least time with the greatest accuracy in result. The book is fully illustrated, and will prove of interest to all engaged in electrical work.

The Ohm.

BY F. W. JONES.

Sir Humphrey Davy, in his researches published in 1821, describes the difference of conducting power occasioned in metals by an increase or decrease of their temperatures; a more detailed and exact statement of this peculiarity being published in 1826 by Wm. Snow Harris, Cummins, and Becquerel. It was reserved for Dr. G. S. Ohm, of Nuremberg, Germany, to conceive and promulgate the true mathematical theory of the galvanic current expressed in the conventional equation of $C = \frac{E}{R}$, in which E is the electromotive force, R is the resistance and C is the current, demonstrating the law that "the strength of the current in a wire or other conductor is directly proportional to the difference of potential between its ends and inversely proportional to its resistance."

Ohm, whose name has become immortal, gave to the world the idea that resistance was the property of a conductor, and that the force of a battery overcame the resistance and produced a current. Sir Humphrey Davy had described the voltaic battery as continually reproducing a charge somewhat analogous to that of a Leyden jar, which was discharged as soon as a conductor allowed the fluid to pass.

Very shortly afterward, various experimenters adopted methods of their own in reducing by calculation the resistance of all parts of a heterogeneous circuit into a given length of some part of that circuit for the purpose of arriving at a unit of comparison.

Lenz, in 1838, states that one foot of No 11 copper wire is his unit of resistance, and that it is 10^9 times as great as the unit he used five years earlier. This appears to be the first choice of a definite length of wire, and denominated a unit.

In 1843 Professor Wheatstone proposed an improvement by making one foot of copper wire, weighing 100 grains, as a unit, and this eminent scientist in 1840 constructed the first rheostats by which any definite number of units might be introduced into or withdrawn from an electric circuit at pleasure. During the following ten years, numerous units of various materials were suggested by leading electricians, but it is believed that Buff and Horsford, in 1847, were the first to propose the use of German-silver wire in the unit coil.

It was in 1846, about the time that English underground wires were being introduced, that the need of a reliable standard unit of resistance was realized, and we find, in 1847, the officers of the Electric and International Telegraph Company employing standard coils similar to Wheatstone's standard.

About 1850, Cromwell F. Varley, Werner Siemens and others attempted the location of distant faults on wires, by the use of rheostats.

In England, the unit was a mile of No. 16 copper wire.

In Germany, the unit was a mile of No. 8 iron wire.

In France, the unit was a kilometre, or = $3280\frac{8}{10}$ feet, of iron wire of 4 millimetres diameter, or about $\frac{1}{4}$ of an inch.

Up to 1860, of all the numerous standards proposed, there was not one free from some serious objection, either being affected by changes of temperature, or difficult to reproduce exactly.

Dr. Siemens in this year constructed a standard consisting of a column of pure mercury, 1 meter, or $39\frac{37}{100}$ inches long, having a section equal to 1 millimetre square, at zero Centigrade, or 32 degrees Fahrenheit.

In 1861, the British Association for the Advancement of Science appointed a committee, composed of Professors A. Williamson, C. Wheatstone, William Thomson, W. H. Miller, Fleeming Jenkin and Dr. Matthiesson, to determine the best standard of resistance. The committee paid special attention to the various metals and alloys and their action under other influences, so as to secure some one that could be selected for representing in permanent form a reliable standard unit. Gold-silver alloy was thought to be the least liable to change and could be best reropduced. At this time was discussed the need of an absolute unit of resistance which could be made to harmonize with the metrical or centimetre—gramme—second system, and it was conceded all around that there should exist some method of measuring and expressing the work performed by electricity similar to the system in use to measure the work done by steam, and this could only be done by bringing into harmonious relations the fundamental units of mass, time and space, and the four electrical quantities of *current*, *electromotive force*, *resistance* and *quantity*. This absolute unit was to enable us to determine and express correctly the unit of work performed by the unit E. M. F., acting through the unit resistance in the unit of time. The unit of absolute resistance had to be established in order to determine the values of the other quantities, just as it is necessary to have a correct one foot measure, to estimate the horse-power of a steam engine. Weber's great mind had opened up this subject very clearly and forcibly, and paved the way for such a determination, and the consummate skill and mathematical powers of Sir William Thomson devised a plan by which the absolute unit has been very accurately established. It is about one thousand millionth the resistance of our practical ohm.

I apprehend it would be a very difficult matter, if not an impossibility, to give a popular explanation of the methods and apparatus used to accomplish the result; briefly, it was by a revolving coil of wire in the field of the earth's magnetism. The motion of the coil about a vertical diameter among the lines of force induced currents in the coil, and a magnet suspended in the centre of the coil was deflected by the currents in the coil; thus by very abstruse mathematical calculations of the dimensions of the coil, velocity of rotation and deflection of the magnet, with several other factors, the absolute unit of resistance in the absolute system was ascertained.

The committee of 1861 merely proposed and planned the work for succeeding committees which were greatly enlarged by the appointment of all the noted European scientists and electricians of that day; Prof. Joseph Henry, of this country, being officially consulted in the matter of the investigation.

In 1863 a second meeting of the committee was held, at which the subjects of the previous meeting were more fully discussed and elaborated. The great need of an authorized standard of practical resistance was being felt by practical electricians who had in charge submarine and land wires requiring accuracy of measurements, both in the construction, submersion and tests, and here the committee was spurred on by this state of affairs, and had the double duty of deciding the magnitude of the unit and of choosing a suitable material for its construction. It having been found that nearly all metals were subject to unaccountable changes in time, no standard was approved and issued until after the third meeting of the committee, in 1864, when several copies were deposited in the Kew Observatory.

The metals used were an alloy of 66 per cent. silver and 34 per cent. of platinum, it being claimed that this alloy altered less in resistance by change of temperature than any known alloy or simple metal. Its resistance increased $3\frac{3}{10}$ per cent. by an increase of 100 degrees of heat Centigrade, and its conducting power was only about half that of German silver, and it was not altered by baking in a temperature of 100 degrees for several days, and annealing did not affect it. It does not oxidize by exposure to air, is pliable, and can be drawn to a great degree of fineness. The wire was double covered with silk and imbedded in solid paraffine.

The 1865 report of the committee announces the accomplishment of establishing a unit of resistance, and its general adoption by leading telegraph and cable companies and electricians, although the stability of the materials employed was not absolute. In 1867, and subsequently, the committee had extended its investigations more into the domain of the absolute and theoretical units which were formulated and set forth in 1871, and in 1873 the metrical standard was adopted in England in preference to the foot, pound and second.

At the Electrical Congress in Paris, in 1881, a commission of European savants went over the whole ground, and published the following resolutions establishing the various units, at present recognized the world over.

1. In electrical measurement, the three fundamental units shall be adopted—centimetre, gramme and second.

2. The practical units, the ohm and the volt, will preserve their actual values, viz: 10^9 (= 1 billion) for the ohm, and 10^8 (= 100,000,000) for the volt.

3. The unit of resistance, the ohm, will be represented by a column of mercury of one square millimetre section at the temperature of zero Centigrade.

4. An international commission shall be appointed to ascertain by new experiments the length of the column of mercury of one square millimetre section at the temperature of zero Centigrade which will represent the value of one ohm.

5. The current produced by a volt through an ohm shall be called an ampère.

6. A coulomb shall be that quantity of electricity defined by the condition that an ampère gives a coulomb per second.

7. A farad shall be the capacity defined by the conditions that a coulomb in a farad gives a volt. The present ohm is represented by a column of pure mercury, 1.06 metre long and 1 square millimetre section.

The International Committee on Electrical Units, which met in November, 1882, in Paris, decided that when the length of a column of pure mercury of one square mm. section, and having a resistance of one ohm, shall have been determined to within one part in one thousand, it shall become the standard ohm.

Congress of United States appropriated $12,500 for scientific purposes, and Prof. Rowland, of Johns Hopkins University, was given charge of the subject of the standard units for electrical measurement.

In April, 1883, the International Commission reassembled in Paris, and adopted the following resolutions:

Resolution 1. The legal ohm is the resistance of a column of mercury one square millimetre in section and 106 centimetres in length at the temperature of melting ice.

Resolution 2. The Conference expresses the desire that the French government will transmit this resolution to the different states, and recommends its international adoption.

Resolution 3. The Conference recommends the construction of primary standards of mercury conformably with the resolution above adopted, and concurrently the use of secondary scales of resistance in solid alloys, which should be frequently compared with each other and with the primary standard.

Resolution 4. The ampère is a current whose absolute measure is 10^{-1} in electro magnetic units C. G. S.

Resolution 5. The volt is the electromotive force that sustains the current of an ampère in a conductor whose resistance is the legal ohm.

The United States government and other governments were called upon to sanction the proposed units as international standards, and the subject was introduced at the Electrical Conference held in Philadelphia in September, 1884, when Prof. Henry A. Rowland, President of the Commission, asked for remarks on the ohm, and said that 106 centimetres did not exactly represent the result of experiments, 106¼ being nearer. Sir William Thomson stated that "the general opinion at Paris was that 106.2 is nearer the truth than 106, though able men who had made careful experiments went on the other side of 106; some as much as one-tenth and two-thirds, some even three-tenths below 106. The average, however, came within a very small fraction of 106—less than one-tenth. The thing that seemed to be quite sure was that 106 was nearer the truth than any other integral number, though most persons present seemed to think 106.2 to be the nearest decimal. The adoption of 106 was not considered to be practically inconvenient, even though more extended observations may give a number different by one, two or even three-tenths. A box of resistance coils or a set of standards, put together in any way, of German silver or of any other metal that might be adopted for standard resistance, would still remain a useful practical instrument for measurement. It would only be necessary to alter the designation on the label of the box as to the temperature at which the resistances contained in it are correct. For practical purposes even, where measurements are not of the very most minute accuracy, any difference of temperature must be taken into account. Even if the material be German silver, there is a change of resistance amounting to three-tenths per cent. per ten degrees centigrade, in round numbers; and there is still more for copper—roughly, ten times as much as for German silver. Thus, by simply changing the designation as to the temperature at which the coils were accurate, which is within the limits of the atmospheric variation within which the resistance coils have to be used, the coils would remain a practical instrument, in the use of which no numerical correction would have to be applied, except such as must be applied at any rate—that is, the correction corresponding to the temperature at which the experiment is made."

It was stated at the same meeting that the Rowland experiments would finally give 106.28.

Submarine Photography by Electric Light.—Experiments are about to be undertaken by MM. Bonfante and Maisonneuve on deep-sea photography by means of the incandescent light. Upon a smaller scale, and in comparatively shallow water, some success has already been attained in this direction by M. Pinard. In the case, for instance, of a sunken wreck which it might be proposed to raise, it is evident that if a camera could be arranged so as to be placed in the hands of the divers, results of considerable practical value might be attained. As for deep-sea photographs, they would probably be more successful if taken with an arc light, and no doubt this could be done with a properly constructed lantern.

The Clark Dynamo.

We have already had occasion to mention the improvements made in the Gramme dynamo by Mr. E. P. Clark, of Owego, N. Y., and now are able to present to our readers further particulars regarding the machine, which is on exhibition at the American Institute Fair, in this city.

In the usual form of Gramme machine, as is well known, the portion of the wire on the armature on the inside of the ring is not under the direct influence of the magnetic field and it was with the object of overcoming this defect that Mr. Clark designed the improvements in the machine illustrated in the accompanying engravings. The complete dynamo is shown in perspective in Fig. 1, and Fig. 2 shows the construction of the field magnets, the armature, Fig. 3, being removed for the sake of clearness.

As will be noted, the field magnets are of the consequent pole type, and so arranged that while the inner pole-pieces are specially magnetized by the short field magnets, the outer pole-pieces are magnetized by the long magnets. Mr. Clark has found, however, that with this construction alone the inner pole-pieces are not so strongly magnetized as the outer ones, and to prevent inequality of action he has added two auxiliary magnets, which connect the inner pole-pieces and are energized by the same current as the others. In this way a uniform action is obtained.

The armature has a spider at one end of the ring, so that the coils fit into the grooves in the pole pieces, as will be readily understood.

Tests which have recently been made of the machine show it to be well designed, as the figures given below show. The machine was belted to a dynamometer and run at 850 revolutions per minute. After some time, readings were taken from the dynamometer, ammeter and voltmeter, and they were as subjoined:

Current (C)	9	amperes.
Potential at terminals	759	volts.
Power applied (W)	7,871	watts.
Friction of machine running idle (F)	307	watts.
Internal resistance of machine	6.1	ohms.
External resistance (r)	84.3	ohms.
Total resistance (R)	90.4	ohms.
External electric energy C^2r.	6,828	watts.
Total electric energy C^2R	7,322.4	watts.
Efficiency of conversion $\frac{C^2R}{W-F}$	96.81	per cent.
Commercial efficiency $\frac{C^2r}{W}$	86.74	per cent.

From the above it would appear that the addition of the internal field magnets is of undoubted benefit. The machine as exhibited at the American Institute is well finished throughout.

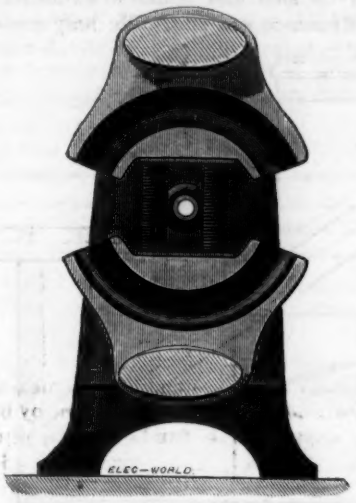


FIG. 2.—FIELD MAGNETS OF CLARK DYNAMO.

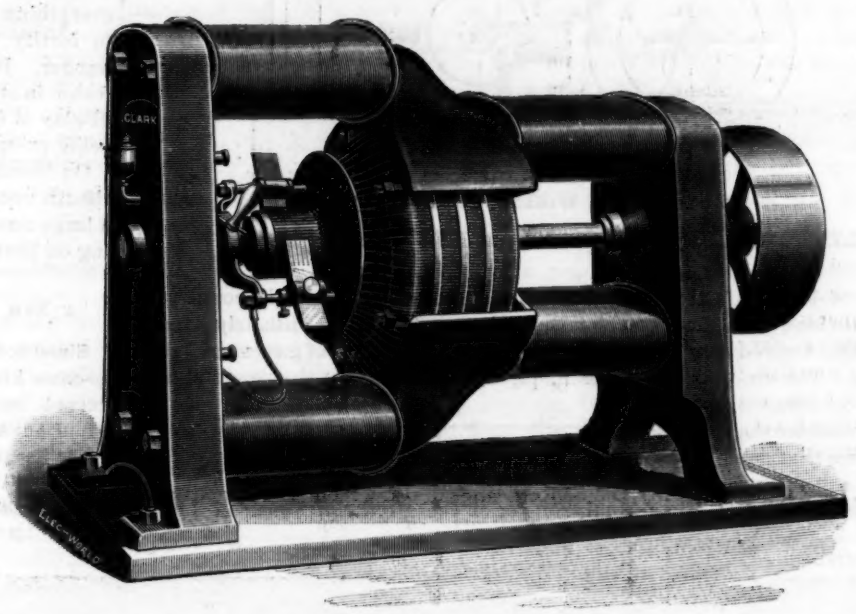


FIG. 1.—THE CLARK DYNAMO.

Some Points in the Theory of Magnetism.*

BY FREDERIC A. B. PERRINE, D. SC.

Something over a year ago, while at Princeton College, my attention was drawn to a remarkable series of results published by Prof. John Trowbridge, in *Silliman's Journal*, where he states that when a permanent magnet is cooled to — 20° C. it loses 66 per cent. of its original magnetism. Some doubt being expressed concerning the accuracy of these results, it was determined to institute a series of experiments to test them, which was accordingly done, and resulted not only in a confirmation of his results, but also pointed out the fact that as one cooled a permanent magnet the moment at first increased to a maximum, and then decreased, this maximum appearing, with the magnet used, at about — 10° C.

Somewhat similar results have been obtained by M. Favé (*Comptes Rendus* LXXXII., p. 276), but they have not been confirmed by the experiments of Gaugain, Defur, and Wiedemann. The discrepancy seems to me, however, to be explained by the fact that the temperatures used by these latter experimenters were not low enough to reach the maximum, consequently they only observed an increase of the magnetic moment on cooling the magnet. My experiments seem to me to point to an incompleteness in the theories of magnetism cited by Wiedemann in *The Electrician* for July 9. Quoting Hughes, he says, (*a*) "Each molecule of a magnetic metal is an unalterable molecular magnet," and there is, further, (*c*) "a rigidity which retains the molecules in their position after the cessation of the active forces." This "rigidity" is what has commonly been called "coercitive" force of the metal, and depends on the temperature of the magnet. If these two are the only active forces which govern the molecules when once directed along the axis of the bar, the only effect of changes of temperature would be the increase or decrease of the coercitive force, together with a change in the dimensions of the bar. The increase of the magnetic moment on cooling would in this case be due entirely to the increase of the coercitive force, and would rapidly approach a constant value which would never exceed the intensity of the original magnetization: for after the coercitive force had become sufficient to retain the amount of magnetism any further increase would be of no effect. Indeed, I cannot see how a reduction of the temperature below that of the original magnetization would have any effect toward increasing the magnetic moment, for since permanent magnetism is but the residual effect of the magnetizing force, the maximum of magnetic moment should be at a temperature where the coercitive force is equal to its value at the time of magnetization. My experiments clearly show that not only does the magnetic moment continue increasing to a temperature much below that of the original magnetization, but that it also reaches a maximum, and beyond that point begins to decrease again, and from Prof. Trowbridge's experiments seem to decrease very rapidly till there is a total disappearance of magnetic moment somewhere about the point of the absolute zero.

The true explanation seems to me to rest upon the movements of the molecular vortices of the body. Let us suppose that the vortex atom is impressed by a certain energy—in action analogous to electrical energy—and that the vortex filament of any magnetic body composed of these vortex atoms has a rotational motion about its axis apart from the proper motion of these fluid elements along the vortex lines. This rotation will have two effects, the one tending gyrostatically to keep the filament in a constant plane, the other tending to make the filament act as a magnetic shell by reason of the rotation of the electrical masses in it acting as a current revolving around it.

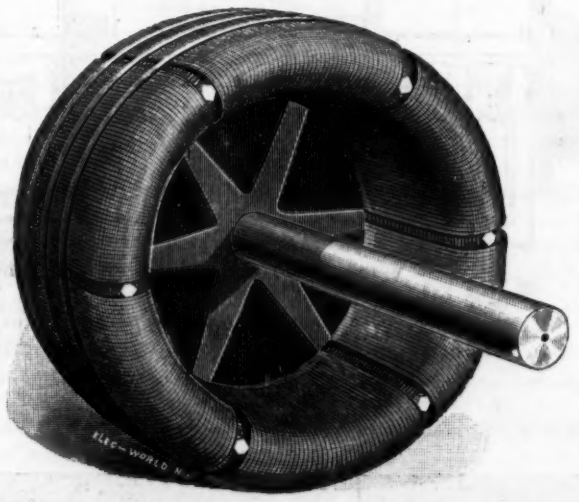


FIG. 3.—ARMATURE OF CLARK DYNAMO.

On this hypothesis, the coercitive force will be due to the positions and movements of the vortices and the gyrostatic action of the vortex atoms, and will be independent of the motions or energy in the vortex atoms, while the magnetic action of any filament will depend both on the rotation of the filament about its axis and on the action of the vortex atom itself. The effect of heat on these vortices is to increase the rapidity of their motions, which will increase both their gyrostatic action and the intensity of the current about them, and in consequence their magnetic action; but, at the same time, it must be remembered that these vortices have a motion in space along their axes, as well as their vortical motions, which overcomes the effect of the gyrostatic action when one raises the temperature to a high point, and hence the increase in volume and loss of rigidity of the body; at the same time, the actions of the vortical magnetic shells upon each other become very intense, and will finally render insignificant both the directive force of former magnetizations, and also, on account of the law of the inverse squares, any present magnetizing force, and forming themselves into closed magnetic circuits, will have no external effect. As one cools the magnet from this point the excursions of the vortices in space are lessened in amount, the gyrostatical forces are lessened, and the mutual magnetic actions of the vortices are reduced below that of the external forces upon them: hence, still turning themselves so as to embrace the greatest number of lines of force, their axes will be turned towards a position parallel to the axis of the bar, the component of the external forces diminishing continuously as they approach this position. This will cause the magnetism to approach a maximum, after which point the effect of a further decrease of the temperature will be to diminish the magnetism by diminishing the intensity of the magnetic shells.

In the case of a steel bar permanently magnetized, and brought to a stable condition by heating, or cooling, or jarring, if the heating has not been carried to the point of total loss of magnetism, cooling will, by reducing the gyrostatic force of the vortices, allow the magnetic forces to direct their axes parallel to the axis of the bar; the magnetism will increase till the component of the directive force, being lessened in amount by reason of the position of the vortices, the decrease in the magnetic intensity will begin to show itself, and, having risen to a maximum, the moment of the magnet will begin to decrease. The total loss of magnetism would occur at—273° C., when the motions of the vortices would cease.

This hypothesis calls in a rotational motion of the vortex filaments around their axes, in addition to their regular vortical motions to explain magnetic action. This assumption seems to me to be warranted by the facts—I have lately been struck with its resemblanee to Rankine's "Theory of Molecular Vortices"—while not, I think, lying open to the objections offered by Thomson to that theory.

Tuning Forks Maintained by Electricity.

In a recent number of the *Philosophical Magazine* Prof. S. P. Thompson suggests an improvement in the method usually adopted for maintaining the vibration of tuning forks by electricity. This arrangement, which is originally due to Koenig, consists of an elect o-magnet placed between the prongs and stylus, which makes contact with a platinum-headed screw, and breaks the circuit when the magnet is excited, just as in the ordinary vibrating bell. With this arrangement it is, however, impossible to obtain a perfectly uniform and regular rate of vibration. Even when the pitch is approximately constant, the phase is continuously varying. Professor Thompson points out that these irregularities arise from the fact that the impetus is given at the wrong instant of the motion, namely, at some other instant than that at which the fork is passing with maximum velocity through zero position of displacement. The professor is, however, able to indicate a very simple solution of the difficulty.

He proposes to take two forks, which must, however, be in perfect unison with each other, and let each act as interrupter to the other, but not to itself, the electro-magnets of either fork being included in the circuit of the contact points of the other. One battery will suffice for the two, for they will not both make contact at the same time. The forks, when once started, will settle down to a difference of phase corresponding to an almost exact quarter of a period; hence each will close the circuit of the other when the lattter is passing through the most favorable position, that, namely, of its normal position when at rest. Under these circumstances there will be no further tendency to vary either in phase or in period.

It is also pointed out that the contact points should be fixed at or near the middle of the length of the prong and not at the end, as is usually the case.

* *London Electrician*, Oct. 8, 1886.

Gas Engines in Electric Light Stations.

Our columns have frequently contained notices of isolated electric light plants in which power is derived from gas engines. But it may strike our readers in this country as curious and even significant that central stations should employ gas engines as prime movers. Such, however, is the case in several instances abroad, the city of Prague, among others, having a central station, from which 200 arc lights are distributed, the motive power being derived from three Otto gas engines of 50 h. p. each. The successful practical application of gas-power on so large a scale abroad can be easily explained when we consider the circumstances involved. While it is well known that gas engines have a much higher theoretical efficiency than steam engines, the price of gas to the consumer in this country is such that they are heavily handicapped in competing with steam engines as a source of power. But if the price of gas be taken as its cost of production, the argument no longer holds good, and the disparity in cost of power between gas and coal ceases to exist. Hence if, as in the case of the city of Prague, the gas is consumed where it is made, viz.: at the gas works, the utilization of gas power on a large scale is perfectly practicable, and is cheap. Numerous gas companies have of late undertaken the installation of electric light plants, and hence the installation at Prague, illustrated in Figs. 1 and 2, is of timely interest. The Otto engines are ranged side by side and belted to a counter shaft, from which the dynamos are run. We may remark that the Otto gas engine is manufactured in this country by Messrs. Schleicher, Schumm & Co., of Philadelphia, who are now undertaking the manufacture of gas engines ranging up to 50 h. p., in order to meet the newer requirements.

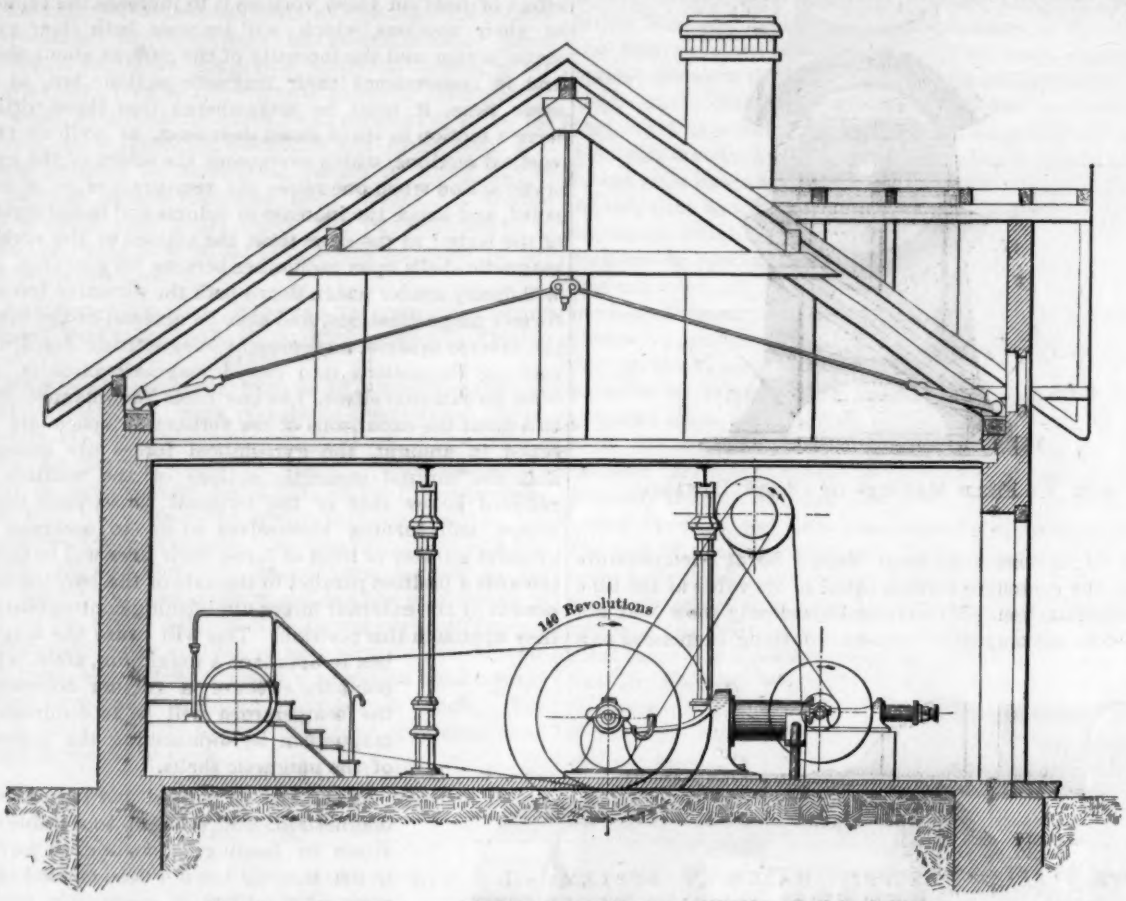


FIG. 1.—PRAGUE ELECTRIC LIGHT STATION—ELEVATION.

The Statue of Liberty Ceremonies.

The formal transfer of the Bartholdi Statue of Liberty from private care to the government took place on Thursday last, Oct. 28, when, in presence of a very large and distinguished gathering on Liberty Island, M. de Lesseps, as president of the Franco-American Union, handed over to President Cleveland the noble gift of the French people. The weather was most unpropitious, but in spite of rain and fog, enthusiasm was universal. New York was beflagged from one end of the city to the other. The streets were thronged all day with crowds. At least 20,000 men marched in the combined military and civil parade, and the number of vessels of all kinds participating in the marine parade has been put at between three and four hundred. Altogether the festival was a great success, and one that will ever be memorable.

The windows of the offices of THE ELECTRICAL WORLD, in the Potter Building, overlook City Hall Square, through which the procession passed, and a great many ladies and gentlemen availed themselves of the opportunity thus offered to view "the passing show." One of the pleasantest episodes of the day was due to the thoughtful hospitality of Mr. E. H. Goff, president of the American Electric Manufacturing Company, which made a gift of the whole costly apparatus for lighting the great statue by electricity. Mr. Goff hired a large tug, the "Haviland," early in the week and sent out invitations to see the marine parade from her. The invitations were gladly accepted, and by noon on Thursday, a large party—one that would have been much larger but for the storm—gathered on the tug, including ex-Gov. H. Howard; Messrs. P. Armington, G. C. Sims, H. P. Frost, E. T. Copeland, J. B. Powell, H. C. Adams, W. J. Johnston, C. E. Stump, T. C. Martin, H. E. Irvine, C. B. Whiting, H. Goff, T. Grimwood, E. H. Hastings, F. A. Sawyer, N. Ross, E. M. Stalker, E. W. Burdett, F. Allen, C. D. Smith, Dr. Shufelt, G. A. Morse, H. A. Stout, L. K. McKinney, B. H. Cook, W. I. Holmes, and several others. Mr. Goff and Mr. J. J. Wood were on the island to superintend the operation of the lighting plant. Under the care of Capt. Gully, and with Mr. Irvine as head of the commissariat department, the party were enabled to see everything of the celebration that the fog left visible and to fortify the inner man abundantly against cold and hunger. It had been proposed to spend the night on the water in order to see the lighting up of Liberty and the display of fireworks, but this was not done, the display being postponed.

On Monday last, Nov. 1, the date fixed ultimately for the firework display, Mr. Goff again engaged a tug, and a large number of gentlemen spent a very pleasant evening on board, witnessing the illuminations and fireworks.

A New Air-Ship to be Propelled by Electricity.

Since economical systems of generating electricity have become known and the electric motor has undergone its recent improvements, the art of ballooning has made rapid advances. The old method of obtaining ascensional force has, up to this time, been adhered to, but it is evident that if an envelope could be found of less weight than the volume of air withdrawn from it, and at the same time strong enough to withstand the pressure of the outside atmosphere when a vacuum is produced by the withdrawal of the air contained within, the object would float in the atmosphere.

It is upon this principle that Dr. A. de Bausset, of Chicago, has designed a vacuum air-ship. The proposed ship consists of a cylinder 46 yards in diameter and ending

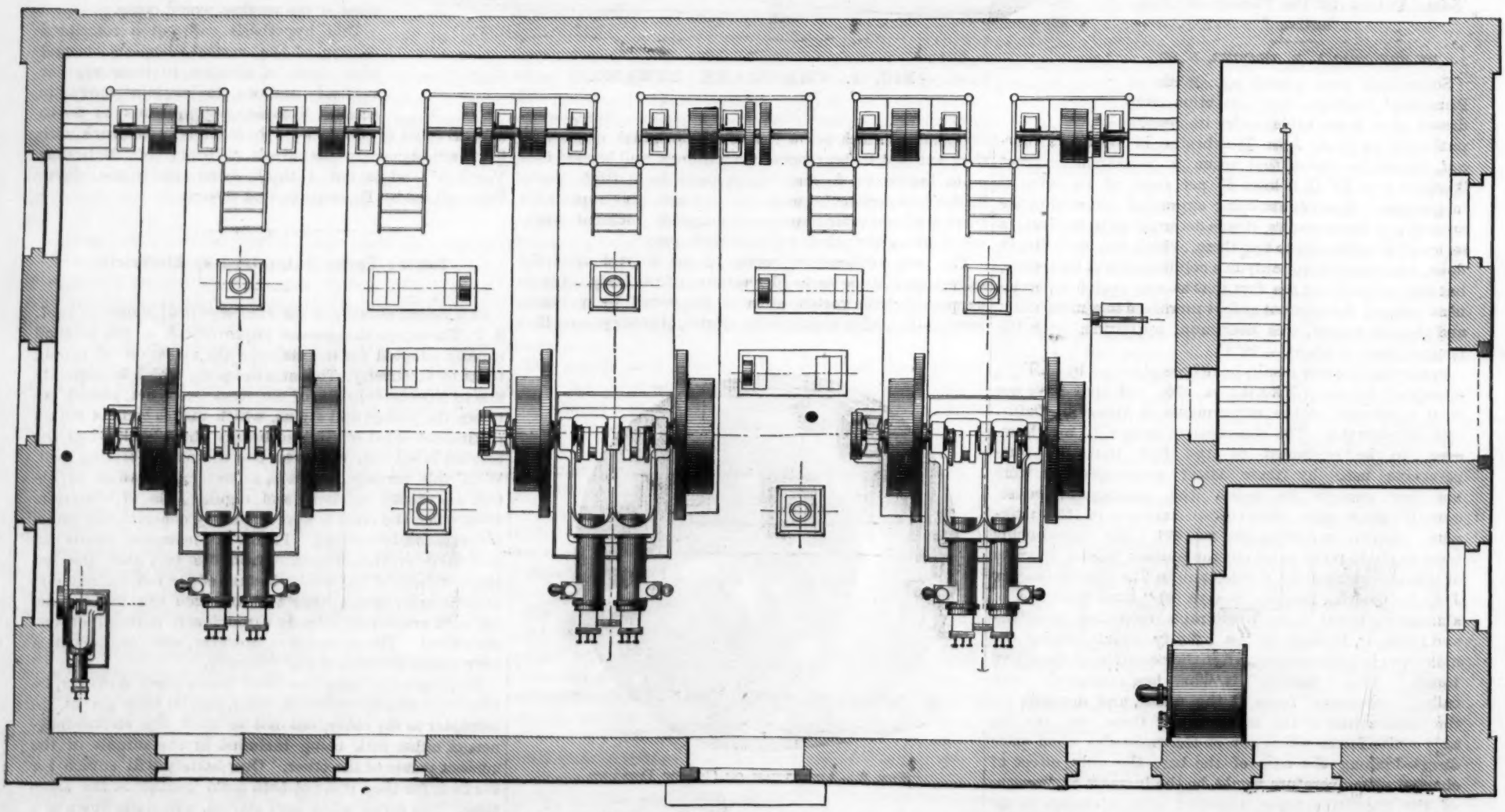


FIG. 2.—PRAGUE ELECTRIC LIGHT STATION—PLAN.

in cones, with a total length of 318 yards. Its body will be made of steel plates $\frac{1}{14}$ of an inch in thickness, the whole weighing 260,680 pounds. The plates have been tested and proved capable of sustaining a pressure double that of the atmosphere. The volume of air contained in such an aëro-plane would weigh 719,707 ponnds. This would give an ascensional force of 459,026 pounds if the vacuum were complete. If only half the air were exhausted, there would still be a very great ascensional force obtained.

This air-ship will be propelled by exhausting air-screws capable of exhausting thirty thousand cubic feet per minute, which, it is calculated, will propel the ship at the rate of 70 miles an hour.

Power for driving the screws will be obtained from an electric motor, which receives current from auto-accumulators sufficient in number to give 100 horse-power. As the force calculated to propel the ship at the rate given above is only 25 horse-power, the remaining 75 will always be in reserve.

In addition to the screws, pumps driven by electric motors are provided for exhausting the air from the aëro-plane when that becomes necessary.

Dr. de Bausset is convinced of the practicability of his scheme, and claims that by this means the difficulties which have attended the handling of gas balloons will be completely removed. With its great ascensional force, the aëro-plane will be capable of sustaining not only its complement of machinery, but in addition a large number of passengers and considerable freight.

The Field Electric Railway System.

The history of electric railroading in the United States, it is well known, dates back long before the discovery of the reversibility of the dynamo-electric machine, and it is not to be wondered at, when this scientific fact became generally known, that, with their usual shrewdness, some of our inventors should have sought to apply the principle of the stationary dynamo acting as a generator and a motor upon the car for the purpose of propulsion. One of the first workers in this branch, and of whose early achievements our columns have already given full account, is Mr. Stephen D. Field. It is not necessary to recall Mr. Field's past work, interesting as it may be, because it is familiar; but we propose to give here the details of his latest experiments, which, as far as completed, are on the eve of practical demonstration.

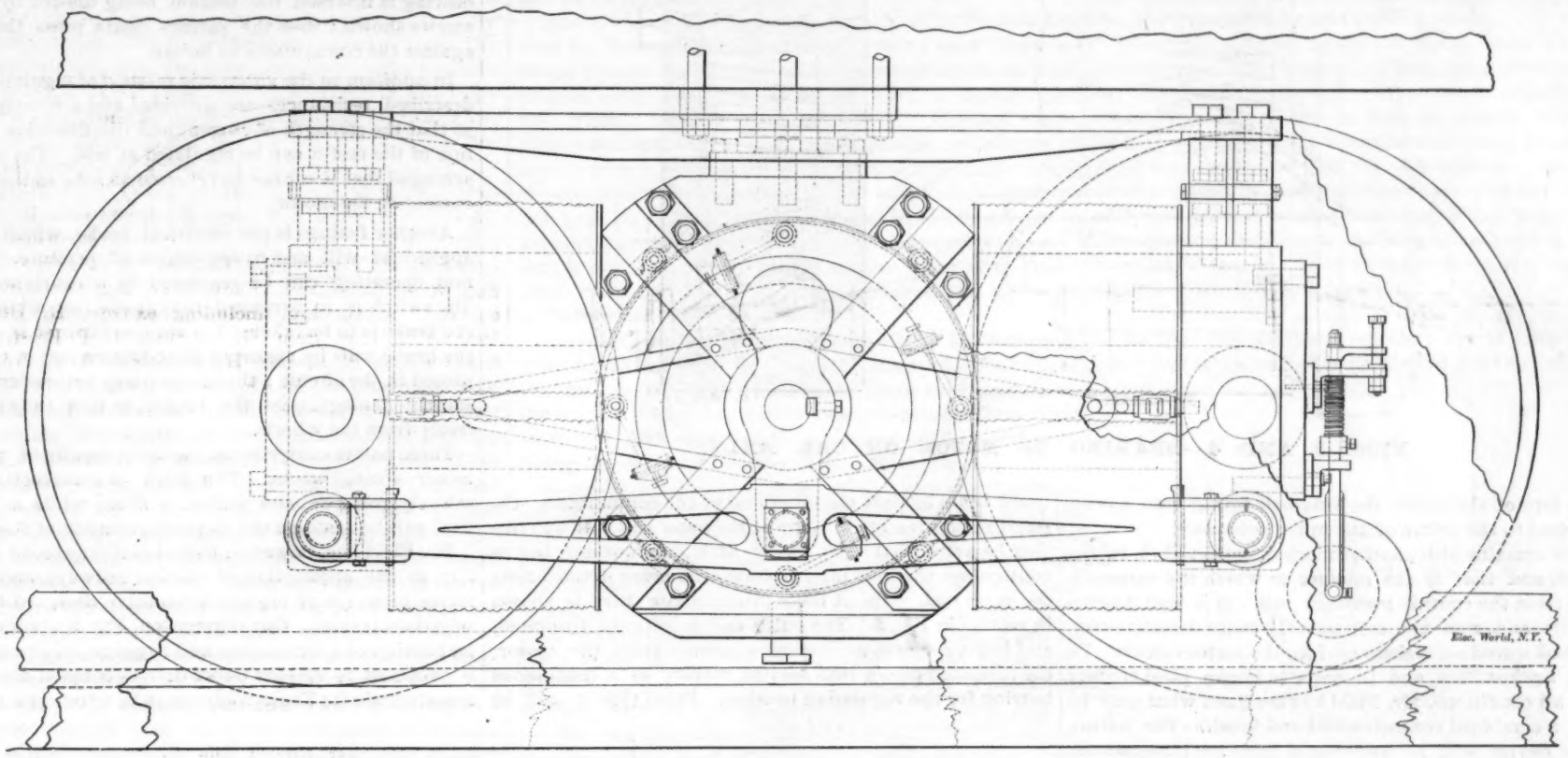


FIG. 1.—MOTOR AND TRUCK, FIELD ELECTRIC RAILWAY SYSTEM—SIDE ELEVATION.

Being, like others, impressed with the special applicability of electric motors to the propulsion of the cars on the elevated railroads in this city, and encouraged in this project, we believe, by his uncle, Mr. Cyrus W. Field, Mr. Field has for some months past devoted his special attention to the problem involved, and has so far matured his plans that actual work of construction is now progressing, looking to a practical test.

The electrical and mechanical details comprising Mr. Field's system are a decided departure from the many original ones which have been already described in these columns, and show that the fertility of resource of the inventor is undiminished.

Taking in review the mechanical details first, it will be seen that between the wheels of the car truck a single motor is situated, the armature shaft of which is connected directly to the wheels by means of a crank and side connecting-rod similar to that employed on steam locomotives. This is clearly shown in Figs. 1 and 2, which represent, respectively, a side and an end elevation of the truck as it is being constructed. The cranks, as shown, are, for obvious reasons, keyed to the armature shaft at an angle of 90 degrees.

The manner of suspension of the motor is clearly shown in Fig. 1. The upper and lower field magnets, which form consequent poles, are held together by the usual iron connecting pieces or yokes, and through each of these passes an axle of the truck, so that the entire weight of the motor is equally distributed on both axles. The bearing, however, is not a rigid one. Although, as stated above, the axles pass through the yokes of the field magnets, it will be observed, Figs. 3 and 4, that the latter are made up of two pieces, or perhaps, to put it more correctly, that a cap is bolted to the real connecting piece at each end. Fig. 3 shows the bearing in end elevation and part of the adjoining wheel; while Fig. 4 is a sectional view which shows the usual spring interposed between the weight and the bearing. The cap maintains the spring and bearing in position and allows the motor free vertical motion without strain, due to inequalities in the road-bed.

The armature turns in bearings formed by the junction of four brass arms on each side of the armature, and these arms are in addition bolted to braces on each side,

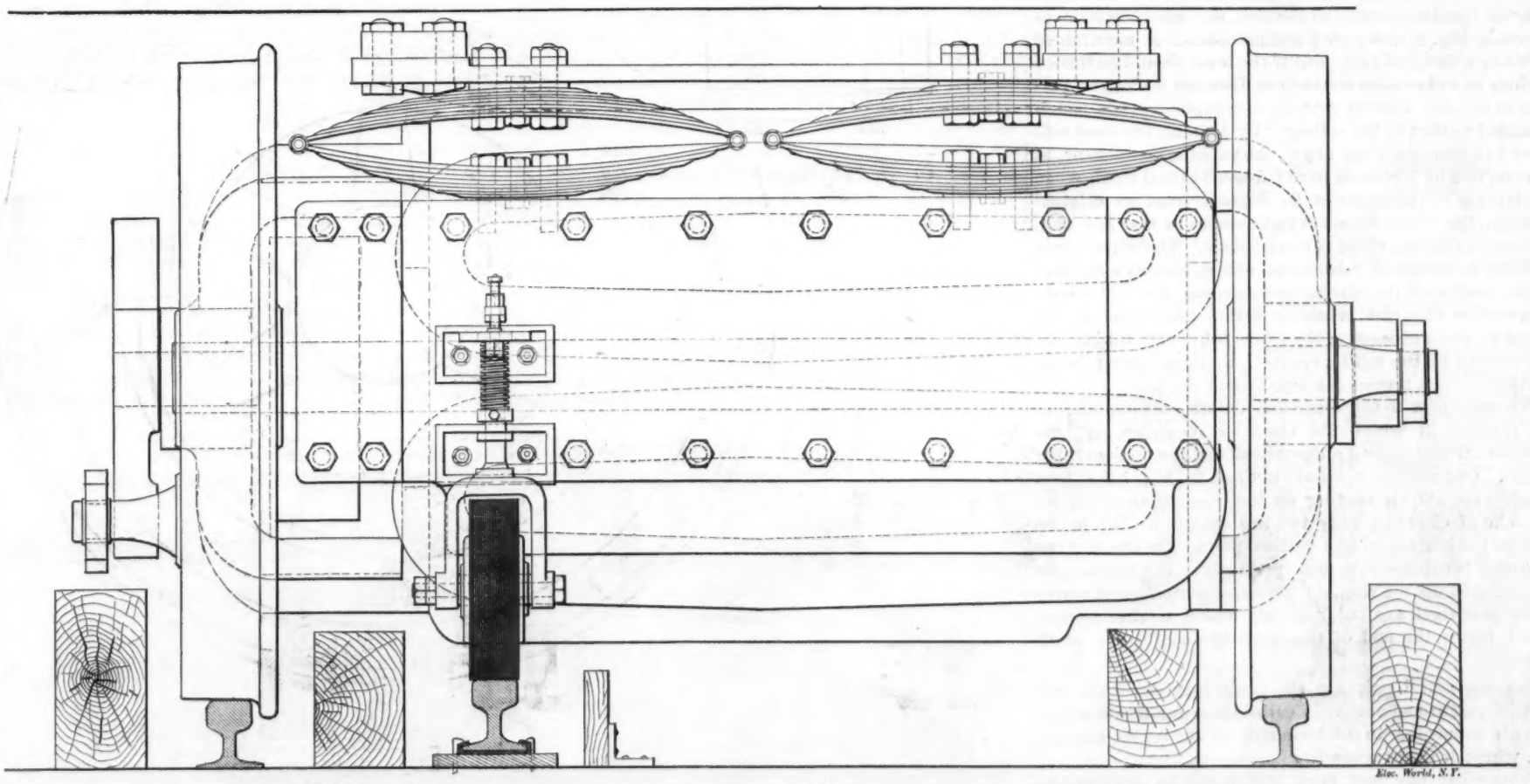
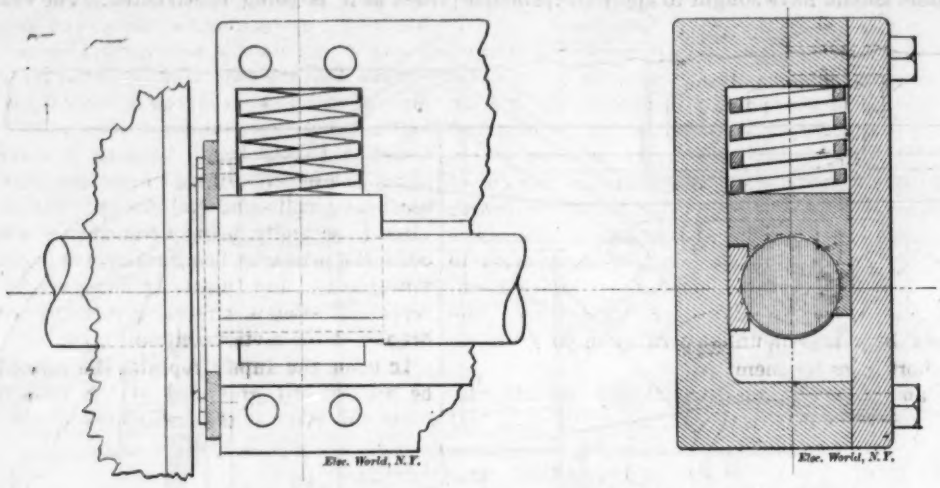


FIG. 2.—MOTOR AND TRUCK, FIELD ELECTRIC RAILWAY SYSTEM—END ELEVATION.

which converge and are joined to the connecting piece of the field magnets by means of bolts and turnbuckles. In this way all horizontal motion of the motor relatively to the truck is prevented, while at the same time its vertical motion is not restricted.

The body of the car rests on springs, which are bolted to the tops of the yokes, the king-bolt fitting into a bearing bolted to the centre of the upper pole-piece.



FIGS. 3 AND 4.—BEARING OF MOTOR ON CAR AXLE.

There remains still another mechanical detail to be described, and that is the manner in which the current is taken from the central insulated rail. It is well known that dirt and rust not infrequently cause defective contacts and introduce resistance into the motor circuit. To guard against this, and in order to insure good contact under all conditions, Mr. Field has designed what may be called a combined contact-wheel and brush. The nature of the device will be understood from the illustrations, Figs. 1 and 2, which show the contact-wheel held by brackets bolted to the yoke of the field magnet.

The wheel itself is built up of alternate layers of discs 6 in. and 9 in. in diameter, of thin spring brass, so that each large disc is flexible, and in bearing upon the rail can be given a bending motion. It will be noted, at the same time, that the forked rod supporting the wheel passes through two brackets, above the upper one of which is a lever attached to the rod. This lever can be swung through an arc of 180 degrees and can be clamped in any position; the position of the contact wheel relative to the rail corresponding to that of the lever.

Now, it will be readily understood that when the lever is in the middle position on the arc, the wheel stands as shown in Fig. 2, and only a rolling contact is maintained between wheel and rail. But if the lever should be turned slightly to either side, so that the discs are no longer parallel to the rail, a slight rubbing or scraping motion would be added to that of the rolling. By turning the lever still more and increasing the angle, the rubbing component, as it were, can be increased to any desired extent until, when the lever is at an angle of 90 degrees from its original position, the wheel stands at right angles to the rail and, obviously, rubbing alone can take place. The wheel being built up in the manner described above, acts as a resilient brush, taking off the current and keeping the rail clean. It is evident that this brushing action need only be resorted to when necessary, the wheel otherwise taking up the current by the rolling contact, a spiral spring being provided which presses the wheel upon the rail.

We come now to the electrical details, taking up first the manner in which the motor is regulated and the brushes are maintained automatically at the non-sparking points. Our readers will have noticed in Fig. 1 that four brushes are shown bearing on the commutator, but for the sake of clearness only two are shown in Fig. 5, one each of the horizontal and vertical pairs. The office of the auxiliary brushes will appear presently. The brushes are all mounted upon a ring, on the outer periphery of which screw gear teeth are cut, and into which meshes a screw which forms the end of the armature shaft of a small motor.

The horizontal pair are the main brushes, while the vertical pair are what may be called the regulating brushes, and are connected to the terminals of the regulating motor, which is shunt wound.

From what has just been said, it will be evident that when the normal amount of current passes through the motor, the regulating brushes bear upon the commutator at points of equal potential, and hence no current passes through the regulating motor. Now if while in this position any change of load or speed occurs, the diameter of commutation would be changed, and the regulating brushes not yet having changed their position, would bear upon points between which there now exists a difference of potential. This evidently would cause a current to pass through the regulating motor which would be started revolving in a direction corresponding to the change of conditions. The turning of the little motor gearing with the ring causes all the brushes to be shifted simultaneously until the regulating brushes reach again points of equal potential, when evidently the little motor stops for want of current. The main brushes will at the same moment have arrived at the proper diameter of commutation. In this way the motor accommodates itself automatically to changes of load or speed.

There are several details in connection with this regulating device which are also worthy of notice. By referring to Fig. 6, it will be seen that while the lower main brush bears against the inner end of the commutator, the small regulating brush bears at the outer end. It will further be noted that only every fifth commutator bar is continuous, the four intermediate ones being divided near the outer end. One of these intermediate bars is shown in section in Fig. 6. The outer end is entirely insulated, and hence receives no current whatever from the motor; the insulated pieces thus serving merely as a continuous bearing for the regulating brushes. From this it will be seen that while, as usual, the main brushes are in continuous electrical contact with the motor, the regulating brushes only make contact at every fifth commutator bar. In this way the regulating motor is caused to act under short impulses of current. The effect of this is that while the regulating motor is started promptly, it comes to rest very quickly when the brushes reach the neutral point where they should remain, and thus they are prevented from traveling beyond that point by the momentary impulses which otherwise would immediately send reverse currents into the motor.

The brush-holders being rigidly attached to the ring, some provision must be made for guarding them against injury, as they bear almost vertically against the commutator. This is accomplished in a manner shown in Figs. 5, 6 and 7, which give different views of the brush-holders. The brushes, as will be seen, are held in a clamp provided with pivots which slide in slots in the holder, the brushes being pressed toward the commutator by two springs. Now, when the direction of rotation of the armature is reversed, the brushes are pushed inwardly a short distance and then carried over until their angle of bearing is reversed, the motion being limited by the stop screws shown; then the springs again press the brushes against the commutator as before.

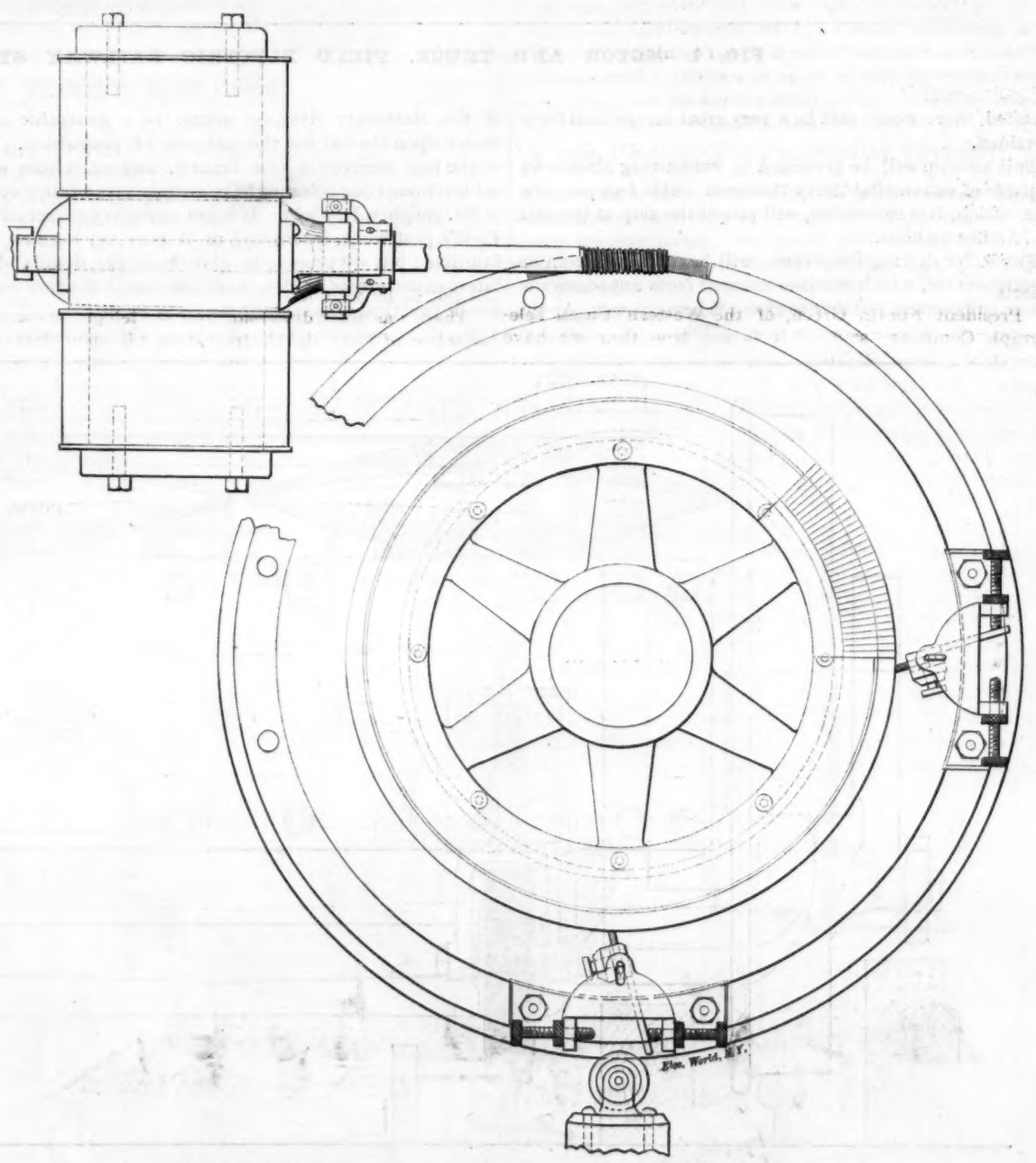


FIG. 5.—REGULATING MOTOR AND ADJUSTABLE BRUSHES.

In addition to the automatic method of regulation above described, resistances are provided and a reversing lever, so that the strength of current and the direction of rotation of the motor can be regulated at will. The lever is so arranged that it cannot be reversed as long as there is any current in the motor.

Another feature is the electrical brake, which may be applied at will and to any degree of pressure. The current operating can be regulated by a resistance switch. The switch is so arranged that at the last section, when the brake is to be taken off, a reverse current is sent into the brake coils by means of an induction coil or condenser placed in the circuit; this momentary reverse current instantly demagnetizes the brakes, so that they fall away freely from the wheels.

These points comprise the essential details of the Field motor arrangements. The work of construction is now actively going on, and within a short while a practical trial will be made on the elevated railroads of this city.

Mr. Field has, however, looked farther abroad than the city in the application of electric railways, and is elaborating plans for an electric locomotive designed for rapid suburban transit. Our illustration, Fig. 8, shows the general design of a locomotive and baggage car combined. It is proposed to employ 6-foot drivers coupled direct to the armature shaft. The machine is to be a four pole Gramme, with an armature 4 feet in diameter, and a speed of from 30 to 40 miles an hour will be attainable.

Sowdon, Elder & Wright, sole agents for the Eastern States for the American system, report business as good in their territory. One of the largest single orders ever filed in this section is that of the Suburban Light & Power Company (composed of gentlemen interested in the Brookline Gas Light Company), just placed with this firm, for the American system and also for the building of a trunk line through Brookline, Brighton and Allston. The Westbrook Manufacturing Company, Saccarrappa, Me., and the Manchester Locomotive Works, Manchester, N. H., have also contracted with the same firm for installations of the same system.

The Control of the Subways.

For some time past reports have been current to the effect that the Western Union Company and the Metropolitan Telephone Company were likely to obtain control of the Consolidated Telegraph and Electrical Subway Company, and the expected has now happened. Mr. Jay Gould, Mr. Edward Lauterbach and Commissioner Flower held a conference at the latter's office on Friday afternoon,

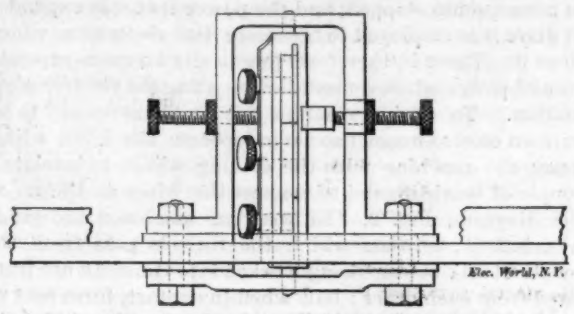


FIG. 7.—DETAILS OF BRUSHHOLDER.

Oct. 29. At its conclusion Mr. Lauterbach said to a reporter: "Our meeting was simply for the purpose of having a clear understanding on all sides of the new phase in which the arrangement I have just completed puts the subway. It is not true that a majority of the stock of the Consolidated Telegraph and Electrical Subway Company has been sold to the Western Union Company, and, though representatives of that company's interest and that of the telephone company will probably become directors at the next meeting, a majority of the stock remains in the old hands. The Metropolitan Telephone Company now owns eight-tenths of the wires in this city, and their business requires a large and constant increase of wires, for which provision must be made underground, as no more poles can be erected. This company, therefore, has all along been willing to identify itself with the underground system, but its action was retarded by the position the Western Union assumed, the Western Union owning about 40 per cent. of the telephone company's stock. This opposition has now ceased. A consulting corps of engineers, representing the varied interests, will meet and decide upon the best general plans for routes, material and capacity of all the required lines of subway. Thus the Subway Company has not only obtained all the money required for about two years' work, but by the pooling of issues the company will acquire, without extra expense, the combined skill and experience of the telegraph and telephone experts."

President Norvin Green, of the Western Union Telegraph Company, said: "It is not true that we have acquired a preponderating interest in the Subway Company. Overtures have been made to us to avoid litigation. For several weeks past we have had all the papers prepared to apply for a mandamus to open our Dey street trench, and to string wires on Third avenue. In going into the Subway Company now we do not recede from our position. We still maintain our right to use our own iron conduit and to keep the wires strung on the elevated railroad structure. All our through wires—those leading out of the city—and by far the greater portion of those in use will continue to be run under the elevated railway tracks."

The New York Underground Telegraph Company, which has the local right to use the patents for subway conduits of the North American Underground Telegraph and Electrical Company, and a permit to open the streets granted by Hubert O. Thompson when Commissioner of Public Works in 1883, took the first steps on Saturday night last to secure a legal recognition of their rights and privileges. Their laborers began to tear up Broadway near Wall street, but were soon stopped by the police, some being arrested. The officers of the New York Underground Company are: D. Morgan Hildreth, President; W. H. Johnstone, Vice-President and General Manager; and F. W. Ritter, W. S. Taylor, George R. Thompson, J. B. Ecclesine, Jr., Carl Edelheim, Joseph C Herr and W. E. Findley, directors. The officers of the North American, or parent, company are: Lewis May, President; W. H. Johnstone, Vice-President and General Manager; Henry Allen, Treasurer; Percival Farquhar and William B. Dowd, directors. The case is now being heard on its merits, so far as relates to the rights conferred by the old permit.

At the meeting of the Electrical Subway Commissioners on Nov. 1, a permit was granted to the Western Union to place temporarily, until such time as the subway is completed, wires or cables along the Third avenue elevated structure from Harlem River to the South Ferry, provided that the telegraph poles along the route be removed before Jan. 1.

Commissioner Moss reported, in response to a resolution, that the Metropolitan Telephone Company have in use, between Twenty-first street and Forty-second street, on Sixth avenue, sixty-five poles, upon each of which are stretched 150 wires. In the same district the Western Union Company has thirty-five poles, each having an average of twenty-four wires. Between Twenty-first and Thirty-fourth streets about twenty-five of the telephone company's poles are being used by the electric light companies to support their electric light wires. As the completed conduit is not designed to carry electric light wires, these poles cannot be removed, unless permission be given to substitute short poles for them.

In accordance with Commissioner Moss's recommendation, it was resolved that notices be served upon each of the companies named, informing them that conduits in the district referred to will be ready to receive their wires on Nov. 15, and requiring them to place all the wires mentioned under ground within 60 days thereafter.

In response to the resolution of the previous meeting, calling upon the construction company to submit plans for lines through 125th street and extending the Sixth avenue section to Varick street, Mr. Lauterbach said that he had been making arrangements for the electrical companies to get stock in the Subway Company. "To have experimented on 125th street," he said, "and in other parts of the city, as required by the resolution, might have not only delayed the practical accomplishment of the work, but have resulted also in great loss to the Subway Company. I think the commission has reason to congratulate itself on the present phase of affairs. Consultations are being held between the experts, and it seems probable that they will find a way of making one trench for both arc and incandescent wires. The Metropolitan Telephone Company is the principal customer of the subway, and its wants therefore are entitled to attention. They have applied for permission to renew their poles on Fifty-eighth street on the ground that they are rotten and dangerous, but if they are permitted to substitute for the Harlem line an eight-duct conduit from Third avenue through Fifty-eighth street to the East River, the wires can be put under ground."

There was much discussion over the telephone company's selection of Fifty-eighth street, Commissioner Hess objecting that the location of the Steam Heating Company's boilers and pipes in that street already blocked it, and it was finally decided that Fifty-sixth or Fifty-seventh street be chosen. An experimental section of conduit, composed of paper tubes prepared in melted paraffine and laid in hydraulic cement, will be laid in the new section at once.

An application from the Metropolitan Telephone Company to lay a conduit, consisting of an iron pipe in a wooden trough, from Spring street and Broadway to the North River was refused, on the ground that the subway system should be uniform and inclusive.

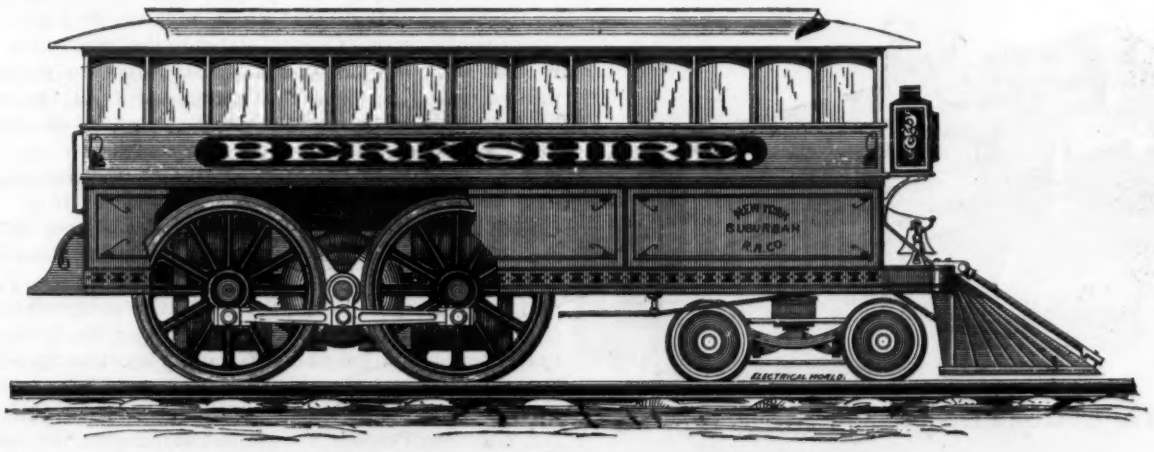


FIG. 8.—PROPOSED SUBURBAN CAR, FIELD SYSTEM.

Duplex Telephony.

BY DR. A. M. ROSEBRUGH, TORONTO, CAN.

As attention has recently been called to duplex telephony I desire to place on record what I have accomplished in this direction.

I commenced experimenting over two years ago on the wires of the Bell Telephone Company, of Canada, between Toronto and Hamilton, a distance of 40 miles, the wires being placed at my disposal for that purpose by Mr. C. F. Sise, the General Manager. My object was to utilize the metallic circuit system so that either two subscribers or a subscriber and a central office operator at each end of a metallic circuit might be able to communicate simultaneously without interference. Through these and other experiments I was enabled to develop a duplex telephony system. With the assistance of Prof. Sylvanus P. Thompson I obtained an English patent for my duplex system, the application being filed and "provisional protection" obtained in August, 1885.

During these experiments, my great difficulty was to protect the subscriber's receiver from the central office transmitter.

It is obvious that by placing a transmitter in either branch of the metallic circuit, the electrical currents will divide at the junction with the ground wires, one portion continuing in the metallic circuit and the other portion being short circuited by said ground wires.

I saw that the only solution to the problem was to generate the electrical impulses in both wires simultaneously, and in opposite directions. After much experimenting I found that this could be done in several ways, as, for instance, first, by using a transmitter with a doubly wound secondary coil—one coil for each branch of the metallic circuit; secondly, using a transmitter with two induction coils, the primaries being connected either in series, or in multiple arc, and thirdly by using what I call a "duplex repeater,"—that is, a repeater with two coils—one in each branch of the metallic circuit.

In using the duplex repeater the repeating circuit may be cut, one end grounded at the central office and the other end taken to the switch-board for the use of subscribers. By this arrangement two subscribers at each end of the metallic circuit may use said metallic circuit simultaneously, one using the "duplex repeater" and the other the ground wire. In the one case the currents traverse the two branches of the metallic circuit in opposite directions; in the other case, the currents pass the two wires in the same direction, simply using the two wires as a double conductor. It is not difficult to render the central office receivers neutral to the currents from the subscribers' transmitters. A simple method is to wind the electro-magnets double, and insert one coil in one branch and the other coil in the other branch of the metallic circuit.

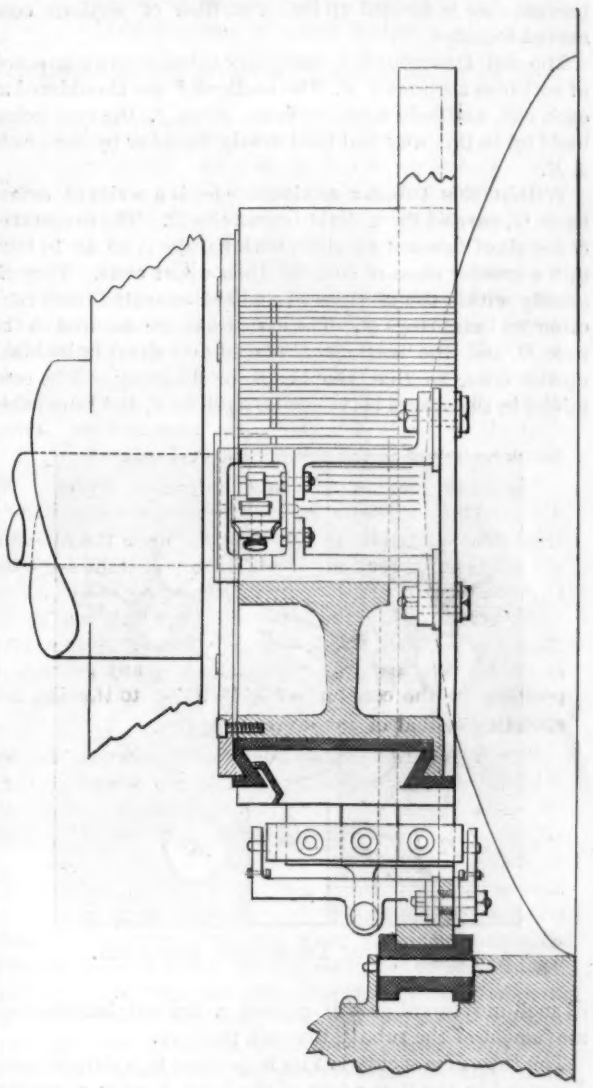


FIG. 6.—DETAILS OF COMMUTATOR.

I thus found that by charging the two branches of the metallic circuit simultaneously, and by using differentially wound receivers in said metallic circuit, the ordinary transmitters and receivers could be used in the subscribers' lines.

The obvious advantages arising from this system are as follows:

1. Rendering duplex telephony practical.
2. Facilitating long-distance telephony.
3. Eliminating induction.

Young Dr. Green.—Miss Amy Hewitt, daughter of Abram S. Hewitt, will be married to Dr. James O. Green on November 15, at Ringwood, Mr. Hewitt's country seat in New Jersey. Miss Hewitt is a charming girl, bright, cultured, amiable to a degree, says a flaneur in the *Graphic*, and with that indefinable charm of manner that makes us so often term a girl "jolly" and "popular," without being able to say just why we think her so. Mrs. Hewitt is a sweet, womanly woman, a worthy daughter of a worthy sire, and her children are very like her. With such a mother, with Abram S. Hewitt for a father, and Peter Cooper, of blameless life and beloved memory for a grandfather, can one doubt that everybody ought to congratulate "young Dr. Green" on his success?

A New Telephone Repeater.

A decidedly novel arrangement for repeating telephone messages, and one that is at the same time adapted for use generally as a relay, has recently been devised and patented by Mr. Moses G. Farmer, the veteran electrician. In the accompanying illustrations, Fig. 1 is a plan view of the apparatus, and Fig. 2 a vertical central section of the same. The electro-magnetic or primary part of the device consists of two concentric helices, either or both of which may be divided into a number of sections or independent coils. Within the inner helix is a stationary soft-iron core composed of a number of separated or magnetically insulated tubular sections. Within the section are armatures, all of which are secured to a rod or tube, which is connected with the contacts or otherwise arranged to transmit its movements or vibrations to one or more of the contacts. Referring to the figures, it will be seen that *A B* are two circular heads of insulating material held together by the rods *C*. Between the heads are the coils comprising the helices, of which the inner coil, *D*, is of comparatively coarse wire, with but few turns, while the other coil, *E*, is of finer wire, with a large number of turns. The coil *E* fits loosely over the coil *D*, and in the present case is divided up into a number of sections connected together.

The coil *D* surrounds a stationary tubular core composed of soft-iron sections *F F*. The sections *F* are shouldered at each end, and held apart by brass rings *f*, the core being built up in this way and held firmly together by the heads *A B*.

Within this tubular sectional core is a series of armatures *G*, carried by a light brass tube *H*. The armatures *G* are short tubes of soft iron with flanges *g*, so as to contain a greater mass of iron at their upper ends. They fit loosely within the sections *F*, and are separated from each other by brass rings *g'*. The armatures are secured to the tube *H*, and the sections *F* placed over them in building up the core, so that the heads or flanges *g* will be contained in the spaces between the sections *F*, and be capable

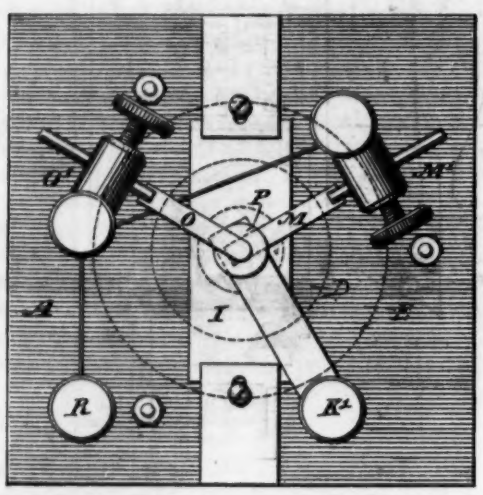


FIG. 1.—NEW TELEPHONE REPEATER.

of such movement as will permit a limited longitudinal movement of the tube *H* through the core.

The tube *H* is secured at its upper end to a strip of mica *I* secured to the upper face of the head *A* over a central perforation therein. Its lower end extends down through the head *B* and is held in position there by two thin flexible metal straps *N*. To the upper end of the tube or rod *H*, or to the mica strip *I*, is secured a metallic cup *K* containing a carbon button *i*. Upon this rests a metal electrode or contact *L*, which is a small platinum pin passed through the end of a thin resilient metal strip *M*. Upon this rests a carbon button *P* in a socket carried by a resilient metal strip *O*. The cup or socket *K* is electrically connected with a binding-post *K'* and the strips *M*, *O*, are supported by adjusting holders *M'*, *O'*, shown in the plan view, which are electrically connected together and to the binding-post *R*. Other binding-posts, *S*, *S*, are placed on the base of the instrument—two for the inner and two for the outer coils. In preparing the instrument for use, the intermediate contact *L* is adjusted so as to press lightly upon the lower contact *i*, and the upper contact is set so as to just touch the contact *L*. When in operation, the coil *D* is connected up with a small battery, which furnishes sufficient current to magnetize the cores. The outer coils *E* are connected up in the primary or independent line, and the first part of the secondary or dependent line, which in practice is the primary circuit of an induction-coil, is made through the contacts by connecting it with the parts *K R*. The effect of the current flowing through the coil *D* is to magnetize both the sections *F* of the stationary core and the armatures contained within them, and by reason of their relative positions to impart the same polarity to their corresponding or adjacent ends. The upper end of each inner core or armature, being larger than the lower, and being also somewhat nearer to the lower end of the stationary section next above, is attracted by the core above and repelled by that surrounding it. The current impulses in the coil *E*, acting upon the core thus affected, tend to produce, by means of this conjoint attraction and repulsion, a movement or vibration of the inner cores or armatures in line with their axis, which vibrations, being imparted to the contacts, reproduce in the secondary or dependent circuit corresponding impulses.

Irish's Generator for Electric Stop Motions.

The electric stop motion is employed to automatically stop machinery on the completion of its task, or on any

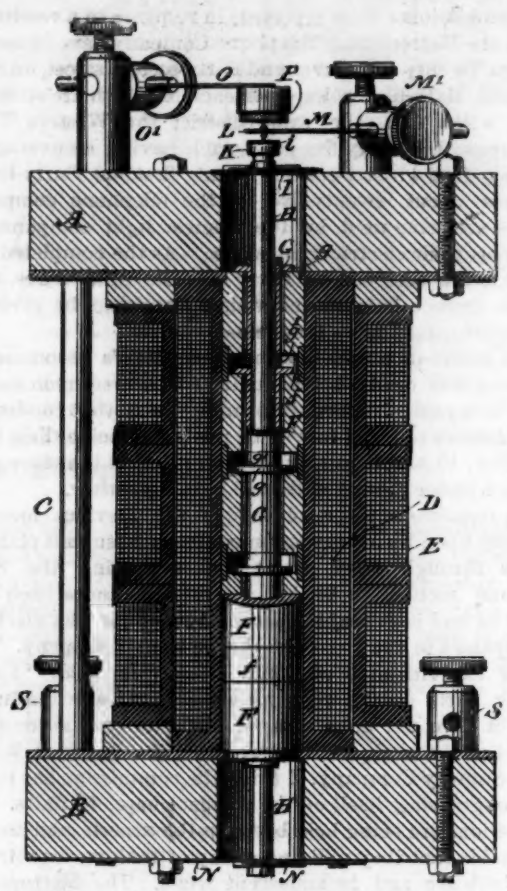


FIG. 2.—NEW TELEPHONE REPEATER.

irregularity occurring which may be detrimental to the work it is executing. It avoids the necessity of keeping a continuous personal supervision and watch on each machine as it performs its work, which would otherwise be essential, and enables one attendant to serve several machines perfectly where otherwise he could only, with difficulty, attend to one. This stop motion is applicable, and an invaluable adjunct, to every description of machinery driven by power, and affords a perfect, instantaneous and independent command over each of the machines, whether there be one or one hundred in operation in a factory, and without affecting or interfering in any way with the engine driving them. The circuit can also be closed mechanically by the simple pressure of a button or the movement of a switch placed near to, or distant from, the machine to be controlled. In all weaving, drawing and reciprocating machines the electric stop motion is now an indispensable appurtenance, the saving in time, labor, and in the prevention of spoiled work by its employment being very considerable.

The little electric generator represented in the engraving, Fig. 1, was specially designed by Mr. W. E. Irish to be employed for the purpose in factories or mills running not more than twenty looms or machines. It weighs, when complete with cover (not shown), about fourteen pounds, and when the armature is driven at a speed of

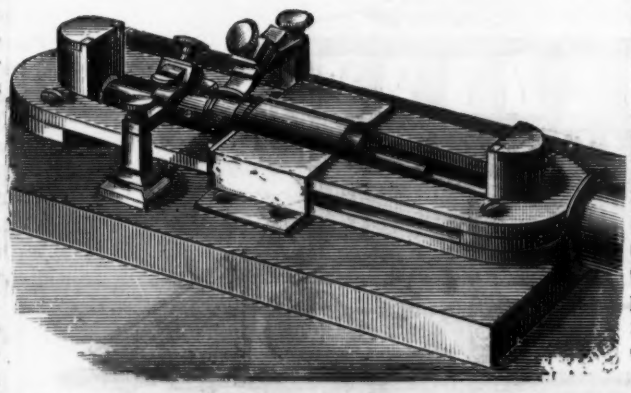


FIG. 1.—IRISH'S ELECTRIC STOP MOTION, GENERATOR.

twelve hundred revolutions will cause an electro-magnet to lift a weight of over seventy pounds. The generator consists of two permanent horseshoe magnets, measuring seven inches long, one inch broad and one-quarter inch thick, placed in the position shown, with their like poles overlapping each other, so as to obtain the greatest magnetic influence on the Siemens armature, which revolves in bearings between them. The oil reservoirs below which the armature shaft takes its bearings are large, easily accessible, and insure good lubrication of the bearings for a considerable time. The commutator, which is of the simplest form, is attached to and rotates with the shaft, which also carries the armature and driving sheave. Adjustable brushes, or collectors, are supported on standards placed outside the magnets; these standards also support the binding posts which clamp the main and return leads. A simple wall bracket usually supports the generator in some out-of-the way place in the machine room or factory, where it can be driven by a belt from the shafting in the same manner as other machines.

The expenditure of power required to drive the generator when running free with open circuit is nil; when the circuit is closed through an electro-magnet, a machine is in consequence stopped, and the power that was expended to drive it is employed to generate the electricity which stops it. There is, therefore, practically no extra expenditure of power whatever entailed by using the electric stop-motion. To equip a machine it is simply necessary to secure an electro-magnet so as to operate the lever which gears the machine with the driving wheel, to insulate a couple of bearings, and to connect the wires as shown in the diagram, Fig. 2. In weaving machines the guide wheels *B B'*, between which the threads pass from the spools *A A'*, before being worked into the cloth are insulated from each other; but, when in contact, form part of the electrical circuit through the generator *M* and electro-magnet *E*, which governs the machine. So long as the slivers or threads are perfect, the tension upon them keeps the guides apart and prevents the circuit being established, as shown in the case of the upper machine. But on the breaking of a thread, its tension ceases, permitting the metallic guides to come in contact with each other, and to close the circuit through the electro-magnet which stops the machine, by attracting the lever *W*, so that it arrests the toothed wheel *S*, as shown in the lower machine. On the thread being renewed, the circuit is again broken, the lever released and the machine put in motion.

An inequality in the thread, which may be detrimental to the work, may also be caused to close the circuit and stop

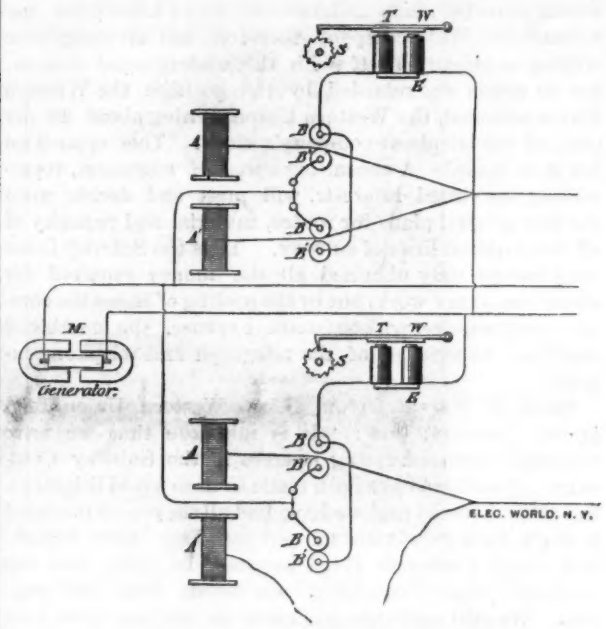


FIG. 2.—IRISH'S ELECTRIC STOP MOTION, CIRCUITS.

the machine. An alarm actuated by the closing of the electric circuit when a machine is stopped is sometimes employed to call attention to the fact.

Telephone Litigation.

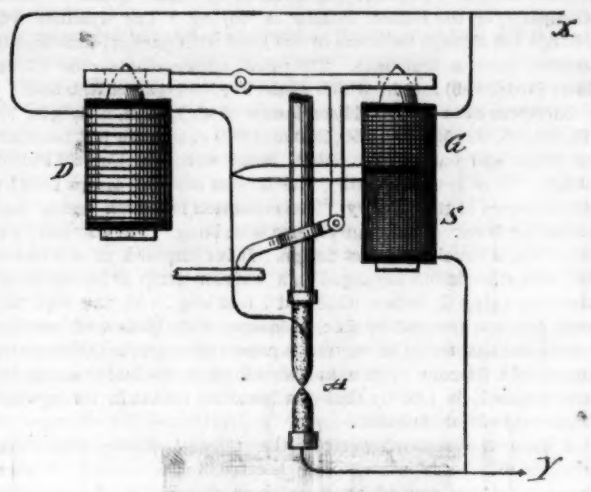
Motions were made in the United States Supreme Court at Washington on Nov. 1 to advance and hear together immediately after the February recess all the cases now on the docket of that court which involve the great telephone controversy. Counsel stated to the court that the records in these cases comprise 25,000 octavo pages of printed matter, and that the argument, if all the cases be heard together, will occupy a week or more. The numbers and titles of the cases are as follows: No. 113, Amos E. Dolbear vs. the American Bell Telephone Company, appeal from the Circuit Court of the United States for the District of Massachusetts; Nos. 667 and 668, the Molecular Telephone Company *vs.* the American Bell Telephone Company, appeal and cross appeal from the United States Circuit Court for the Southern District of New York; No. 1,092, the Clay Commercial Telephone Company *vs.* the American Bell Telephone Company, appeal from the United States Circuit Court for the Eastern District of Pennsylvania; No. 1,164, the People's Telephone Company *vs.* the American Bell Telephone Company, appeal from the United States Circuit Court for the Southern District of New York, and No. 1,165, the Overland Telephone Company *vs.* the American Bell Telephone Company, appeal from the United States Circuit Court for the Southern District of New York. The court took the motion under advisement. The records in these cases are the most voluminous ever presented to the court. Copies enough of the record to supply all the justices in the single case of the People's Telephone Company against the American Bell Company occupy nearly fifty cubic feet of space. It has been stated in a special dispatch from Washington that some of the leading Bell counsel have been in that city attending to the case and in consultation with Prof. Bell.

An Automatic Compensator for Magnets.

In operating electric arc lamps a source of derangement is often found to exist in the changes of temperature of the copper coils, especially for the derived circuit magnet, such changes occurring both during operation from the heating effects of the electric current traversing the coils, and also under conditions of change in the temperature of the atmosphere. There results from this a change in the resistance of the magnet coils, and since in a differential or other lamp depending upon a derived circuit magnet a delicate balance exists between the force of the magnet or other device for separating the carbons and that of the derived circuit or feed-regulating magnet, the change of temperature will disturb this balance and necessitate a readjustment after current has been put on or after a change in the temperature of the surrounding atmosphere.

To obviate this difficulty, Prof. Elihu Thomson has devised a method of compensation by which the action of the regulating magnet is maintained constant, notwithstanding a change in temperature.

One of the ways in which the method is carried out in practice is shown in the accompanying illustration. The coils *D* and *S* are arranged to act oppositely, in the well-known way, to adjust the arc at *A*, *D* separating and *S* causing an approach of the carbons. A German silver coil *G* is in a derivation or branch around coil *D* of copper, and acts magnetically to assist the magnet-coil *S*, as indicated, being wound on the same core.



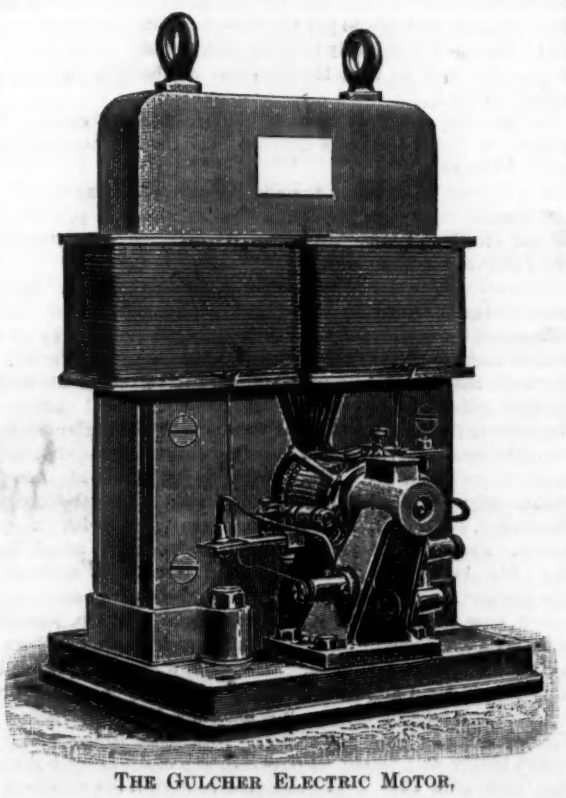
COMPENSATOR FOR MAGNETS.

The operation is as follows: The coil *D*, being traversed by the direct current, acts to separate the carbons until restrained by the counteracting effect of *S*—the derived-circuit coil; but should the coil *S* become heated (*D* partaking of a like increase of temperature) the power of *S* is weakened, because it carries a relatively smaller current than before. This is compensated for, however, by the increased effect of *G* assisting *S*. The current passing through *G* increases because of the increase of resistance of *D* upon increased temperature. The effect of *D* is thereby weakened, and that of *G*, or virtually of *S*, strengthened. The amount of such compensation is governed by the relative resistances of the parts and their number of convolutions. If the resistance of *G* and *D*, when cold, be made equal, and *D* have three and one-half times the number of convolutions that *G* has about the core, these proportions will give practical compensation with copper wire and German silver.

The Van Depoele Electric Railway at Appleton, Wis.

The Van Depoele electric railway at Appleton, Wis., has a number of interesting features. Two turbines coupled together, capable of developing 100 horse-power, are used to run a 60 horse-power dynamo. The electric current so generated is conveyed by means of two heavy copper wires up to the overhead wires for a distance of about one mile. Here the feeders are electrically connected to the double overhead wires, these being placed over the centre of the track, about 18 or 20 feet from the ground, and forming an exact counterpart of the track below. These overhead conductors are so suspended that it is possible for a traveling contact to pass over the wires uninterruptedly from end to end of the track. This traveler, running upon the overhead conductors, brings the current to the motors in the cars by means of a double flexible cable, the latter being so arranged that it can readily be transferred from one car to another. In order to effect this, the cables hanging from the travelers on the overhead wire are fastened with their lower terminals to a cross-bar made of some good insulating substance. To the centre of this cross-bar is attached a handle, and if the handle be grasped the terminals of the cables can be hooked into two corresponding sockets, fastened to the under side of the roof on the front end of the car. From these sockets the current is led by means of insulated copper conductors to the motor and to a switch, and, in the usual way, by turning the handle either to the right or to the left more or less current can be sent through the motor, or be altogether shut off when the car is to be stopped. In the present case the motors are placed on the front platform of the car, so that the driver can sit near the motor and have at once full view of the road upon which he is running. As the motor is placed upon the front platform of the car, it is at all times under the eyes of the driver. This enables him to take good care of the machine and to see that all working parts are in good order and kept clean. From this point he can also attend to oiling of the shafts, etc., so that there is no reason to neglect any important work.

VAN DEPOELE ELECTRIC RAILWAY, APPLETON, WIS.



THE GULCHER ELECTRIC MOTOR.

The motor itself is a very plain but very substantial machine, of the type illustrated in our columns recently. The commutator brush holder is provided with two pairs of brushes, and is so arranged that by turning the handle either to the right or to the left, the motor can be made to run back or forward. On starting a car the driver turns on the current gradually until the maximum speed of the car is obtained, a speed which, for street cars, is ordinarily from 6 to 8 miles per hour.

In the present plant five motors, one of 12 horse-power and four of 10 horse-power, are connected as follows: From the armature shaft of the motor a phosphor bronze pinion meshes perfectly in a large gear wheel carried underneath the motor, by a solid steel countershaft. Mounted upon the latter are two sprocket wheels, corresponding to two other sprocket wheels fixed solidly to the forward axle of the car; upon these sprocket wheels runs a specially made steel belt, so that on starting the motor the armature shaft revolves its pinion upon the large gear placed upon the counter shaft, and the latter communicates motion to the axles of the car by means of the intervening sprocket wheels and steel belts. The grade varies from 6 to 9 per cent., and in one place a sixty-foot curve occurs on an 8 per cent. grade; there are numerous curves 40 or 50 feet radius. The view is taken from a photograph.

The Gulcher Electric Motor.

A compact and efficient form of motor, which we illustrate in the accompanying cut, taken from *Industries*, is now being manufactured by the Gülcher Electric Light and Power Company, Limited, England. It is designed by Guy C. Fricker, electrical engineer to the company, and we understand that six of these machines were supplied for driving some of the exhibits at the Bingley Hall, Birmingham, where they were seen at work during the meeting of the British Association. The armature is of the "Gramme" type, having a core of square cross-section and great radial depth. The winding consists of a single layer of wire on the periphery of the ring, and is heaped up five deep on the inner annulus. A point of some interest is also presented in the construction of the armature core, which is built up with iron wire of rectangular cross-section, insulated with varnish. By this device the waste space in the interstices of the iron is so far minimized that the actual weight of a core is more than 90 per cent. of that of a solid one of equal dimensions. The field magnets are of the single horseshoe type, and are provided with side cheeks, by which the magnetic resistance of the air space is somewhat reduced. The motor from which our illustration is taken is capable of developing from 1 h. p. to 1¼ h. p. at a speed of about 2,200 revolutions per minute. Its weight is 162 lbs., and the makers say that a return of as much as 75 to 80 per cent. of the power supplied is developed on the brake.

The Schuyler Company.—It is now proposed to effect a reorganization of the Schuyler Company, under the name of the Schuyler Electric Manufacturing Company. This new concern is to have a capital stock of $500,000 in 5,000 shares of $100 each. Of this stock, not to exceed 3,500 shares shall be "preferred," and not to exceed 1,500 "common." With the first class it is proposed, as far as necessary, to meet the claims of present creditors of the old company, and with the second to take up, share for share, the interest of the existing stockholders. The "preferred" stock is to bear interest at the rate of 4 per cent., the "common" not being entitled to dividend until the other is paid in full. The property to be conveyed to the new corporation, subject to liens and attachments to be adjusted, is valued at about $473,000. A circular to the above effect has been issued to creditors, asking their approval, by the creditors' committee, Messrs. S. W. Kellogg, Gideon Welles and E. H. Hyde, Jr., the names to the agreement on behalf of the Schuyler Company being those of Messrs Dustin and Schuyler.

The Bartholdi Statue.

The land that, from the rule of kings,
In freeing us, itself made free,
Our Old-World Sister, to us brings
Her sculptured Dream of Liberty :

Unlike the shapes on Egypt's sands
Uplifted by the toil-worn slave,
On Freedom's soil with freedmen's hands
We rear the symbol free hands gave.

O France, the beautiful ! to thee
Once more a debt of love we owe :
In peace beneath thy Fleur de lis,
We hail a later Rochambeau !

Rise, stately Symbol ! holding forth
Thy light and hope to all who sit
In chains and darkness ! Belt the earth
With watch-fires from thy torch uplit !

Reveal the primal mandate still
Which Chaos heard and ceased to be,
Trace on mid-air th' Eternal Will
In signs of fire : " Let man be free !"

Shine far, shine free, a guiding light
To Reason's ways and Virtue's aim,
A lightning flash the wretch to smite
Who shields his license with thy name !

—*John Greenleaf Whittier, in the Independent.*

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Nov. 1, 1886.

Those who know—as many do—the large volume of business now transacted by Westinghouse, Church, Kerr & Co., find it hard to believe that only as recently as 1882, the firm, then represented by Mr. Church, had modest desk room in the offices of another firm. To-day, the firm employs more than one hundred people, including forty engineers, does a business whose only limits are the rising and the setting sun, and has offices that require all the ground floor at No. 17 Cortlandt street. It is natural that where so many are employed, an occasional meeting for the benefit of all should be desirable, so that sentiments and experience may be exchanged and friendly feelings be cultivated. Acting on this idea, the firm held, on Oct. 13, at the New York offices, a general convention of its own salesmen and outside superintendents, together with experts not connected with the concern, to discuss and settle upon standards to be adopted by them in their average boiler practice. Among the invited guests were Mr. R. K. McMurray, Chief Inspector of the Hartford Boiler Insurance Company ; Geo. E. Barrus, Boston ; Geo. F. Barnum, of the Bigelow Company, New Haven, and M. R. Muckle, Jr., of Philadelphia. An interesting discussion brought out many good points of boiler practice, and the suggestions will be utilized. The appropriate hospitalities of the occasion were in the meantime not forgotten. The firm has in view a monthly series of conferences on engineering subjects, the bearing of which will be of a commercially practical nature.

Perhaps very few people realize how large is the trade that is created by the rapid growth of electric lighting and the electrical transmission of power. The point was forcibly brought home to me last week when Mr. A. B. Laurence, manager here for the Underwood Cotton Leather Belting Company, showed me a list of some recent orders, all taken within the last 60 days. I give it herewith: Edison Machine Works at Schenectady, N.Y., 8 belts ; Edison Illuminating Company, New York, 1 belt ; Schuyler Company, Elizabeth, N. J., 3 ; Westinghouse, Church, Kerr & Co., for plant in Hoboken silk mills, 2 ; Everett's Hotel, N. Y., 1, for Edison system ; Gold and Stock Company, 1, for Edison system ; Bennett Building, N. Y., 2 ; Edison Company, Roselle, N. J., 1 ; Edison United Manufacturing Company, 65 Fifth Avenue, N. Y., 1 ; J. Loth, N. Y., 1, Edison plant ; Edison Machine Works, N. Y., 6 ; New York Safety Steam Power Company, 6 ; Stern Bros., N. Y., 1 ; Bibrough & Haines, Cohoes, N. Y., Edison plant, 1 ; Vera Cruz, Edison plant, 2 ; Buckingham Hotel, 2, for Edison plant ; King's County Oil Works, Edison plant, 2 ; Harlem Electric Light Company, Waterhouse system, 2 ; Daft Company, 1 ; Danville (Pa.) Nail Company, Westinghouse system, 1 ; Edison Lamp Company, Newark, 1 ; Polar Oil Company, Centreville, N. J., 1. The Underwood belt is also on exhibition at the American Institute Fair running a Ball dynamo and the Clark dynamo. Mr. Laurence, I should note, is the inventor of the cement used in the manufacture of these belts.

Chas. A. Schieren & Co. have been awarded a bronze medal from the International Exhibition at Liverpool, October, 1886. It is for their " Electric" leather belting and for superior quality and workmanship. The following recent American testimonals, in the shape of orders, are in keeping with the medal : two belts, 10 in. double, 47 feet long, for the Bartholdi Statue; Edison Electric Light Company, Renovo, Pa., 38 feet and 48 feet, ten inch double; Thomson-Houston plant in a factory at Mauch Chunk, Pa. ; Brigham factory, Waltham, Mass., 32 feet 10 inch, double, for Brush-Swan plant; Brush Electric Light Company, Lafayette, Ind. ; Westinghouse Illuminating Company, Schenectady, N. Y. ; Edison Light Company, Amsterdam, N. Y. ; Kokomo Electric Light Company, Kokomo, Ind. ; J. T. Cowling, Wilkesbarre, Pa. ; and the Excelsior Electric Light Company, Canandaigua, N. Y.

Pearce & Jones have completed a new electric railway signal for W. B. Sterett, of the Standard Railway Signal Company, with the assistance of T. J. Clarke. Two lanterns are used with drop curtain signals. A train coming in or going out on a single track road makes contact with its engine wheels and a circuit is completed including a signal at a distant point, where the " danger " curtain is at once dropped in the lantern, thus advising that no other train enter that section. By means of a relay, a signal is also set, signifying to any train coming behind that a train is ahead with right of way. After the train has passed, the signals for " clear track " are again set.

A model house plant, of which I have before made note, is that at Dr. H. V. Parselle's, East Twenty-first street. It includes an Excelsior dynamo of 40 volts and 20 ampères, and a 2 h. p. Shipman engine. The dynamo is connected with 14 Gibson storage batteries of 1,500 ampère-hours, in series, running thirty 16 c. p. Edison lamps. The plant was installed by Stout, Meadowcroft & Company, on the Edison system of wiring. The dynamo will charge the storage batteries in one hour with current sufficient to run for three or four days. The plant embraces also the Cleveland (Stockwell) motor, which seems to give great satisfaction.

No fewer than 15,000 Edison lamps of ¼, ½, 1, 2, 3, 4, 6, 8, 10, 16, 20, 25, 32, 50, 100, 150, 200 and 250 c. p. have just been put in stock and on sale by Stout, Meadowcroft & Co., 82 Fulton street. This is undoubtedly the largest stock of lamps kept by any concern in the country. The collection is worth seeing and sampling from. The range of size is striking. The company exhibit also a novel skyrocket design. It is composed of a series of 60 miniature lamps arranged on a narrow strip as background, the strip being 3 inches wide and 7 feet long. At the top, fanning out, are grouped 28 six c. p. lamps, with globes of various colors and shades. The current is passed through the 60 lamps by means of a 64-point switch, and the effect, as the lamps at the top are reached, is exactly that of a beautiful rocket in its upward flight and aërial explosion.

I take the following from the *Cornell Daily Sun :* As evidence of the reputation our Electrical Engineering Department is gaining among practical men, it may be of interest to state that already three dynamo machines have been tested here, and a fourth on Saturday, 9th, was under test in the presence of representatives of the company. These machines have been sent here by the manufacturers, although no attempt has been made to bring to their notice the facilities the University possesses for such work. In addition to these machines several electrical instruments have been calibrated for outside parties, and the illuminating power and efficiencies of about thirty incandescent lamps have been determined at the request of the manufacturers. Work like this is laboratory work for our students of the most valuable kind, giving them practice in real work, performed for its results. Opportunities for such practice are rare in colleges or technical schools, and students here appreciate the advantages this work affords. The trustees on Saturday appointed Mr. D. C. Jackson Instructor in Physics for the ensuing year. The number, eighty-two, of students in the laboratory, about ten times the number taking this work up to two years ago, made this a necessity. Mr. Jackson was a Fellow last year, and is already familiar with the methods and work of the department. He will assist in the laboratory work.

Messrs. J. H. Ullrich & Co., 106-8 Liberty street, are not only something of electricians, but they are known to many in the business as the proprietors of excellent fountain and stylographic pens. One reason why these products are so good is that Mr. Ullrich, with his large mechanical experience, himself supervises their manufacture. If a bad pen gets beyond the factory, its return is regarded by him as a personal favor. As a result of good business methods, the operations of the concern have so greatly increased that they have doubled their capacity. Circulars can be obtained on addressing Mr. Ullrich.

The partnership existing under the name of Tucker & Baxter has been dissolved. Mr. C. Baxter will carry on the business of manufacturing electrical goods and supplies as before, at 40 Fulton street, Brooklyn.

W. T. H.

PHILADELPHIA NOTES.

PHILADELPHIA, Nov. 1, 1886.

Mr. Henry Clay, the inventor of the Clay telephone, finding that the courts will not allow him to use his instruments, is now busy upon his plans for a system of pneumatic tubes and switches by which he expects to render the local telephone and telegraph, and the American District service entirely useless. He proposes to lay two systems of tubes—one for messages and another for packages and parcels. The tube for messages will be two and a half inches diameter, and that for packages two feet in diameter. The company proposes to put the message tube into such stores and houses as will be likely to bring them trade. There will be no charge for rent, so that the customer will have to pay only for actual service.

On Saturday last the Edgerton Electric Motor Company filed articles of incorporation in Camden, N. J., with a nominal capital of $500,000.

Doylestown, a thriving town in this vicinity, is agitated over the question of the electric light. The matter will probably be settled on the 24th of November, when bids will be entertained from the various companies.

Partrick & Carter report business as good in all their lines of manufacture, and this is nothing but natural in view of the excellence of the product, its moderate price, and the energy of the firm in keeping abreast of the times. Mr. Franklin Carter, by the way, has a good story to tell of an experience of his with a Quaker customer. This gentleman, from the rural districts of Pennsylvania, called on him and wanted a good burglar alarm—one that would not go off unreasonably and without cause at all hours of the night, like those owned by neighbors of his, but that would only sound forth its warning note when the occasion demanded. Mr. Carter equipped the man with a good alarm, and gave him the usual instructions about keeping his battery in order. Mr. Carter saw nothing of the Quaker for about two years, when, meeting him one day, he asked how that burglar alarm was working. "Oh, just splendid !" said the Friend. " I set it at night and it never bothers me at all. It works first-class." " Well, how are your cells of battery ?" said Mr. Carter, knowing the inability of the average man to keep cells in order. " What may they be ?" asked the Quaker. Mr. Carter told him : " Oh, those things ! Why, I didn't bother with them. I put them in a closet in the bed-room, but soon after that I had some carpenters working about the place and they took those jars out and put them in the barn. They've been there ever since."

The Metropolitan Railroad Company, of Pennsylvania, had their first hearing before the sub-committee of the railroad committee of City Councils, Friday, Oct. 29, relative to the ordinance before Councils granting them the right to build an underground road.

Mr. Pettit, counsel for the company, said that the Metropolitan Company was chartered under the railway law of 1875 ; that they proposed to build a subway entirely covered except in the outlying portions, which would be left open on the top, but could be closed at any future time.

Mr. Deery, engineer for the company, explained the plans more in detail. He showed drawings of the subway, which is to be 26 feet wide and 15 feet high, with double track: also a plan of the car, which will accommodate 38 people. Colonel Hazard, of New York, gave an account of the underground systems in London, also of the proposed underground system of Paris and New York. Mr. R. M. Hunter, of the Hunter Electrical Railway Company of Philadelphia, after referring to air engines and cable-power, spoke upon the use of electricity as the best motive power, being free from smoke and noise, and easily controlled under slow and high speeds.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Oct. 30, 1886.

Mr. J. I. Sabin, of San Francisco, was lately in this city, and is now on a trip further east. While here he ordered of the Western Electric Company Paterson cable to run the wires into the new telephone office in San Francisco, where the multiple switchboard will soon be installed.

The Van Depoele Company shipped 12 motors to Montgomery, Ala., this week, for the electric road there. The Port Huron, Mich., electric road has started up, and the owners are so well pleased that they have ordered two additional motors. The Dix road at Detroit has also ordered another motor.

W. T. Moore & Co., of Chicago, have increased their Van Depoele electric light plant by the addition of 30 lights.

Under the heading of " Will the motors mote ?" a Minneapolis paper printed the following: " It will be seen that the soda motors are doing very poor service. As the first of November draws near, special attention is being drawn to the motor company, as on that date it is understood that the use of steam is to be discontinued below Nineteenth Street. The prohibition of the regular steam motor inside of that thoroughfare is the same that stopped it below Sixth street last fall, on the Washburn bond, under which $500 a day is forfeited, if steam is used within the prescribed limits. It was to meet this that the soda motors were secured, but now that they are here, it is becoming the belief, reluctantly but no less surely, that they will never prove effective. The four sodas are splendid pieces of equipment, so far as the construction and appearance are concerned ; but from what seems to be a failure to comprehend the best methods to utilize the soda powers, the capabilities of the soda motors are delusive and limited. The cost of the motors was $8,000 each, with $25,000 more expended in the plant requisite to " charge" them. The trouble now experienced seems to be in the time required to do the " charging," and the inability to do away with what is called " back pressure." With one of the sodas going out Wednesday there was 80 pounds pressure, with 30 pounds " back pressure," leaving only 50 pounds to work with. It is necessary to have at least 100 pounds pressure to operate at all satisfactorily, so that to secure that 60 pounds of " back pressure" must also be carried. This last is so great that an escape is imperative, but with the escape comes a noise and cloud of vapor surpassing the old steam motor. The course that the motor will pursue is waited with no little anxiety by the many people dependent upon it."

I will only say, in the way of advice, use electricity, gentlemen; use electricity ! the electric motors " mote," and they don't weigh 22 tons or cost $8,000 either. The soda motor is a step back to barbarism, and steam itself is far preferable.

The Giles Anti-Magnetic Shield Company has been incorporated here. Also the Cook County Electric Light Company.

The West Coast Telephone Company, operating under the Pan Electric telephone patents, has recently been organized at San Francisco, Cal. Ex-Senator Hearst and Ex-Governor Perkins are among the incorporators.

Several months ago the Shultz Belting Company, whose belts are favorably known to a very large number of electric light men, of St. Louis, was sued by Herman Royer, of San Francisco, for $1,200,000 damages, the claim being on account of supposed infringement of a patent on certain machinery used in the production of rawhide belting. The amount was finally reduced to $400,000 and the suit attracted much attention in trade circles. On the 4th inst. a decision was given by the court favorable to the Shultz Belting Company.

The following is from a Cincinnati paper : " In 1882 the plan of lighting a locomotive headlight by electricity was conceived by a gentleman of Dayton, O., who, after repeated experimental tests, became satisfied that a system of locomotive and car lighting by electricity was practicable, and he organized a company for the development of such a system. After long and arduous study and experiments in many directions, and fruitless efforts and repeated failures under the first organization, a new association was formed for the purpose of taking up and developing an entirely new system. A party of gentlemen took hold of the matter together, and after a year or more of experimental work, further attempts were abandoned by all except the original mover in the idea ; all the others " deserted the ship," but he, having unlimited faith in final success, remained by the " wheel," and last night sent forth on the Little Miami, on train No. 2, engine 219, a headlight plant which has been invented by Edgar A. Edwards that, if it continues to work as it worked when leaving the L. M. depot, will revolutionize the system of locomotive and car lighting. A company called the Edwards Electric Headlight Company, of Richmond, Ind., was organized yesterday, under the laws of Indiana, for the purpose of pushing the enterprise." The company has the following officers : President, James W. Carpenter, Dayton ; Vice-President, J. H. Kibbey, Richmond ; Treasurer and Secretary, J. W. Carpenter, Jr., Dayton ; Electrician and Superintendent, Edgar A. Edwards, Cincinnati. These gentlemen, with the following, compose the Board of Directors : C. W. Chamberlain, Dayton ; Henry E. Robinson, Benjamin Johnson, M. Cullaton, Richmond ; Harry King, Indianapolis. The capital stock is put at $2,000,000, divided into $50 shares, and it is claimed that every dollar of it is subscribed.

The following chat, clipped from a local paper, will prove in-

teresting, especially to the old timers: "Hiram Sibley is known everywhere in this country as the 'seed man.' Women who plant garden beds know him, or think they do, as well as Frank Siddall, their soap man, or as well as Dr. Price, their baking-powder man. Farmers all over creation know him as the man who sells anything from a shrub to a tree, and who handles about as much timothy as anybody in the trade. Everybody at Chicago knows Hiram Sibley as the builder and owner of the great warehouse just north of the North Clark street bridge. But although all the old women and all the farmers in the country, and although all the people in Chicago know old Hiram Sibley so well, not a dozen altogether, I venture to say, are at all aware that the seedsman and warehouseman was the first great practical backer of the electric telegraph, and that with his money the first line was built that was operated in this country. Hiram Sibley didn't become a fifteen millionaire by raising garden seeds and shipping shrubs. The first telegraph line was built from Syracuse to Buffalo with money furnished by Hiram Sibley, by Speed, of Louisville, and by Cornell, the father of the ex-Governor of New York. Henry O'Reilly, who was afterward editor and proprietor of a newspaper at Rochester, was in the line too. S. F. B. Morse, the inventor, who then lived at Poughkeepsie, was, of course, given a share, because the line was operated under his patents. The office of the telegraph company was opened in Syracuse, in the store kept by old Cornell. The curiosity of the people to see the thing work was so great that for the first week the office was with difficulty kept open. The line paid so well that it was soon extended to Rochester and then on down to New York. This was in 1845-8. When it got down to New York and into Wall street, young Cornell, the ex-Governor, and one of the directors now in Western Union, was the operator at the key at the Wall street end. When it reached Ashtabula, Gen. Anson Stager, who was before his death another Western Union director, was the operator there. These were the Western Union lines proper. But almost immediately after lines began to be built in the West, in the Middle States and in the South. Z. G. Simmons, of Kenosha, and Smith, of Racine, built the Northwestern system. Judge Caton, of Chicago, was operating the United States lines in the Mississippi Valley. In the Southwest, Clowry, Dr. Norvin Green, and Speed, of Louisville, operated the lines from Cincinnati to the Southwest. It was all these lines which the Western Union finally absorbed to make its system. Smith is dead, and his widow is now Mrs. Frank Parmalee. Simmons is alive, and still lives at Kenosha. Judge Caton was made a millionaire by leasing his lines to the Western Union. The old operators of the Southwestern lines are all now in the front of the Western Union management. Norvin Green, who was a doctor at Louisville, who dabbled in telegraphy, but who left the practical management of the old Southwest to Clowry, is now the president of the Western Union. Clowry is vice-president of the Western Union, and manager of the division which earns the most money."

Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes me the following telephone stock quotations:

Bell of Mo.	$150@$151
Central Union	44@ 45
Chicago	375@ 400
Colorado	20@ 22
Cumberland	70@ 75
Great Southern	25@ 27
Iowa Union	16@ 19
Michigan	67@ 69
Rocky Mountain Bell	40@ 45
United	16@ 18
Wisconsin	104@ 106

W. A. K.

THE TELEGRAPH.

T. M. B. A.—Notice is given that owing to the good condition of the funds in the treasury, the Executive Committee has decided to make no assessment for November.

Down on the Bucket Shops.—A well-known newspaper man, "Halston," hears of a movement on foot, in influential Wall street circles, to put down bucket shops in New York, once and for all.

A Big Cable Scheme.—The draft of the prospectus of the proposed Pacific-Australian cable shows that the promoters contemplate asking for two millions sterling ($10,000,000), and expect to get a sixpenny rate across the Atlantic and a twopence-halfpenny rate across Canada to Vancouver Island, and intend charging the public four shillings per word from England to Australia and the press a shilling. They purpose raising one million in ten-pound shares and one million in four per cent. stock, secured on the expected imperial colonial guarantee of £100,000. It is hoped that Canada will contribute £12,000, Australasia £38,000, and the Imperial Exchequer £50.000. The promoters talk of earning a net profit straightway of £150,000. The project is generally regarded as much too sanguine. The only actual promise yet made comes from Hawaii, of $20,000 annually. Canada may offer a subsidy, but neither the Imperial nor the Australian Government exhibits much eagerness. New Zealand may come in, because Vogel has a quarrel on with the Eastern Extension Company and wishes to promote a rival cable.—*N. Y. Tribune.*

THE TELEPHONE.

New England Dividend.—The Directors of the New England Telephone Company, at their meeting in Boston on Oct. 27, declared a dividend of 75 cents per share. The company's gross receipts for the quarter ending Sept 30 were $232,585; gross expenses, $162,774; net earnings, $69,811, being an increase over the corresponding quarter of last year of $9,945.

The Showing for Vermont.—Mr. A. C. Brown, of Montpelier, Vt., writes us: "In the ELECTRICAL WORLD of Oct. 30 I see the Cumberland Telephone and Telegraph Company, of Nashville, Tenn., make the claim that they have 'one telephone station to every thirty-five inhabitants,' thereby entitling them to the first place in the National Telephone Exchange Association 'for thoroughness of territorial development.' Permit me to say that in my exchange in this place I have more than one telephone station for every *thirty* inhabitants, which is a better showing than that claimed by the Nashville Company." This is an excellent record.

Telephonic Mesmerism.—A rather tall story comes from a professor of mesmerism who visited Portsmouth, England, recently. He was "interviewed" by a local reporter, who, after questioning him on a variety of matters, asked whether he had ever succeeded in casting a mystic spell over a subject who was at a distance. "Yes," was the professor's response. "At Glasgow I was successful in mesmerizing by telephone. I had previously experimented on some young men, and I instructed them to place themselves at a telephone in the offices of Messrs. Lipton, who are large butter and egg merchants. I was in Messrs. Currie, Thompson & Co.'s office, and gave them directions by wire what to do. I think expectation had a good deal to do with it, but, at all events, they all went off into a trance, and Drs. White, Granger and Lowe, eminent physicians in Glasgow, satisfied themselves of the genuineness of the phenomena by running pins and needles into them."

Troubles at Rochester.—The following is a special dispatch of Nov. 1 from Rochester, N. Y.: The Bell Telephone Company, of Buffalo, notified its subscribers in this city last week that on the expiration of their contracts a rate of $50 per 500 messages would be charged, with an additional amount for each additional message. At present the rate is only $50 per year for each telephone. An indignation meeting of several hundred business men was held here to-night. An executive committee was formed and it was agreed that if the company adopted the new rate each subscriber would take out his telephone and boycott the company. Over three-fourths of the telephones rented in the city were represented at the meeting. It was decided to organize similar demonstrations in Buffalo and elsewhere. The Buffalo company has control of the Rochester territory. A local committee will endeavor to have an act passed by the next Legislature limiting the rental of telephones.

THE ELECTRIC LIGHT.

Pittsfield, Mass.—Over 200 subscribers have already been secured for electric lights, and wiring goes on apace.

Boston, Mass.—The Suburban Light and Power Company, incorporated by R. Amory and others, has a capital stock of $30,000.

Corry, Pa.—Mr. C. G. Harmon is the Treasurer of the Corry Electric Light Company, which has incorporated with a capital stock of $50,000.

Potsdam, N. Y.—The Potsdam Electric Light & Power Company has been incorporated by W. R. Reed and others. Its capital stock is $22,000.

Norwalk, Conn.—The Norwalk and South Norwalk Electric Light Company has been incorporated by Mr. C. E. Dustin and others with a capital stock of $50,000.

Another Gas Company.—The Racine, Wis., Gas Company proposes to engage in the electric lighting business and has ordered a 60 h. p. Westinghouse engine.

Pittsfield, Mass., is indebted to Mr. F. A. Robbins for its incandescent lighting. A Westinghouse plant is being installed, to serve, at the outset, the business part of the city.

Oneida Village, N. Y.—The trustees of Oneida Village N. Y., have granted a franchise to the American Electric Manufacturing Company, New York, to establish a central station for a system of electric lighting in their village.

A Boston Cafe.—Mr. T. S. McDonald, Washington street, has had a number of Edison lights put in his café. They are run by an Armington & Sims engine, which was installed by the Jarvis Company, and is belted direct to the Edison dynamo.

Carbondale, Pa., is to have a Westinghouse station for 1,000 sixteen c. p. lights. The contract was made with Westinghouse, Church, Kerr & Co., by the Carbondale Light, Heat and Power Company, and is now being executed as promptly as possible.

Mansfield, Mass.—A new factory is being built at Mansfield for the Frenyear & Razee Company, of Manchester, N. H., which will remove there upon its completion. The factory is being built by the citizens, who are endeavoring to have new firms locate in the town.

New Westinghouse Plants.—The Danville, Pa., Nail Company is putting in a 300-light plant, the Pennsylvania Steel Company a 400-light plant, and the Pencoyd Iron Works, Philadelphia, a 400-light plant. The erection of the Pittsburgh 2,000-light plant has begun. The Greensburgh, Pa., plant is about finished and will start up by November 15.

Hell Gate Light.—Acting Secretary Fairchild gave orders on Oct. 28 for the extinguishment of the electric light in the tower at Hell Gate, New York Harbor, from and after Dec. 1. This action was based on the recommendation of the Lighthouse Board, and because of complaints from mariners that the dazzling character of the light made it a detriment instead of an aid to navigation.

Gas Statistics.—The President of the American Gas Light Association, A. E. Wood, of Syracuse, stated in his address before the annual convention in Philadelphia, that there are 1,080 gas companies in the United States and Canada. Of this number 153 are set down as water-gas plants, which number includes small plants erected for lighting factories, mills, summer residences and hotels, as well as those used as auxiliaries to coal-gas works.

Charlestown, Mass.—The Charlestown Gas and Electric Light Company is successfully running electric lights. Its steam plant was erected by the Jarvis Engineering Company, Boston, and consists of a six-foot tubular boiler set with the Jarvis patent boiler setting, and an Armington & Sims engine. This is connected with the dynamos direct by belting. The exhaust is run through a National feed water heater that raises the temperature of the water to 210° F. The fuel used is what is called breeze or coke screenings. It is thoroughly wet before firing, taking about 40 per cent. of moisture. In the process of burning, the moisture in the coke is converted into hydrogen gas; the boiler furnace is so arranged that hot air (oxygen) is delivered on top of the fire. This uniting with the hydrogen gas from the moist coke makes a hydro-oxygen or compound blow-pipe flame, the hottest flame known to science, and the result is the boiler furnace is filled with a volume of gas flame, using fuel that is supposed to have all the gas taken out of it, in the retorts. When this class of fuel is sold it generally brings about $1 a ton. Taking it on this basis, it costs the Charlestown Gas Company about $1.50 a night for fuel to run all night fifty full arc lamps.

APPLICATIONS OF POWER.

Denison, Tex.—The Denison Street Railroad Company proposes to use electricity as its motive power.

Littlehampton, Eng.—The plans proposed for the electric railway at the above watering place are to be carried out. Mr. Magnus Volk has the work in hand. The total cost will be about $60,000, of which about $15,000 will be spent on the railway plant.

Baltimore.—Mr. L. O. Richardson, engineer in charge of the Daft electric railway, writes to *Mechanics* that the road is working very satisfactorily. The motors are running 192 miles a day, and there are no delays whatever.

The Main Motor, invented by Prof. W. Main, and owned by the River & Rail Electric Light Company, is now being manufactured in the smaller sizes for sewing machines, dental lathes and light tools. It is said that several are being made for launches for next season.

Sprague's Railway System.—A very successful test of the Sprague system was made last week on the Thirty-fourth street elevated branch. The cars were lit by Edison lamps on the plan devised by Mr. E. H. Johnson. Among those present at the trial were Chief Engineer Sloane, of the Manhattan Railway Company, and Gen. James Jourdan, President of the Kings County Elevated Road.

New York's Desire.—Under the caption "Speed the Day," the *Evening Telegram* says: "We trust that the reports of the success of experiments with electric motors on the Third avenue elevated road may be confirmed. This substitution of electricity for steam would save the city from nuisances of smoke, noise, dirt and drippings, which the public has endured for seven years with a patience surpassing Job's submission to boils."

The Holroyd Smith Tramway System.—For purposes of demonstration, says the London *Electrician*, a short tram line upon the Holroyd Smith system has been laid down near Paris, in a field not far from the Porte Maillot. The track is about 230 yards in length, and takes the form of a horseshoe, while the level also dips considerably in the sharpest part of the curve. The line is thus well calculated to exhibit the capacities of the system, and we are pleased to hear that a car carrying forty-five passengers has been tried upon it very successfully. The line has already been visited by several prominent French engineers.

Got Their Eye on It.—From the proceedings of the fifth convention of street railway men at Cincinnati, it is evident that many of them have "got their eye on" electrical developments. Mr. T. C. Robbins presented an admirable report on the working of the Daft road at Baltimore. One of the best known delegates, Mr. Wharton, of Philadelphia, said he had applied for a franchise for an electric road in Fairmount Park, and expressed a strong belief in the ultimate success and general use of storage batteries for street car service. He thought that the three-rail system would be of infinite value for suburban traffic.

London, Eng.—Recently a trial trip was made from Stratford Church to Manor Park, London, with an engine constructed by the Electric Locomotive and Power Company, Limited, upon the system of Mr. Elieson, illustrated recently in our columns. The company are manufacturing motors on this system, to be used on the North Metropolitan Tramway Company's lines along the route traversed, but they cannot be used for ordinary traffic at present, owing to the company's Act of Parliament not providing for other than horse-power. A bill is before Parliament for conferring the required authority, but it is "hung up" until the next session at the stage which it had reached in the session lately ended. The bill being unopposed, its speedy passing is looked for, but in the meantime the construction of the new plant is being proceeded with. The trip to Manor Park (two miles and a half) and the return journey were successfully performed, the running being very easy and steady, at the speed of an ordinary car.

PERSONALS.

Mr. A. H. Bauer, a well-known electrician of Baltimore, has succeeded Mr. C. F. Hutchinson as manager of the Baltimore & Ohio office in Boston.

Miss Ellen Sprague Stager, youngest daughter of the late General Anson Stager, is, it will interest many old friends of the family to know, engaged to Lord James Butler, present heir presumptive to the Marquisate of Ormond in the peerage of Ireland.

Mr. James D. Reid, dean of telegraph superintendents, is the youngest man in the business. He is now studying French to beguile his leisure, and rumor has it that at a recent amateur concert on Madison avenue he sang a song in costume. No wonder the telegraph got such a good start in the early days!

Mr. Joseph H. Lyon, the attorney for the Third Avenue Railroad and the son of that road's superintendent, is one of the most assiduous society men about town. Just now he is making flying excursions to neighboring towns to inspect electric motors with a view of establishing a system of that kind on the Third Avenue road.

Lieutenant Woodruff, of the United States army, who has been on duty here inspecting the Signal Service office, and is to superintend the laying of cables between Capes Charles and Henry, has had much experience as an Indian fighter, and has taken part in many sanguinary struggles with the savages in the Far West.

Mr. John W. Weston, C. E., managing editor of our excellent Chicago contemporary, the *American Engineer*, has been appointed Commissioner General for the United States of the Paris International Exposition of Railway Appliances and Congress, 1887. The exposition, marking the semi-centennial of railways in France, promises to be important, interesting and successful. Electricity will play no small part in the display of inventions and appliances.

MISCELLANEOUS NOTES.

Electric Mail Boxes.—The New York Electric Mail Box Company, of New York City, has been incorporated by C. H. Parsons and others with a capital stock of $50,000.

An Important Discovery.—We understand, says the London *Electrician*, that a discovery of some importance has been made at the Munich public electrical laboratory. A new alloy of nickel, to be called "nickeline," has been found to possess a specific resistance considerably higher than that of German silver, together with a still smaller temperature co-efficient. Some little doubt rests at present upon the accuracy of this statement, as the figures given by the authority from which we quote are not of an intelligible character. If the information is correct the Munich public laboratory, of whose constitution we recently gave an account, will have fully justified its existence.

SPARKS AND FLASHES.

The Edi-Sunlight.—Edison says that he can do his best work at night. Certainly that is when his best work shows up the brightest.—*Boston Post.*

BUSINESS NOTICES.

The Ide Engine.—It is stated that Messrs A. L. Ide & Son have licensed the well-known Union Iron Works, San Francisco, Cal., to build the Ide engine for the Pacific Coast and territories.

Magnetism in Watches.—

THE UNITED STATES ELECTRIC LIGHTING CO.

C. C. WARREN, 216 *La Salle Street,*
Manager Western Department.

CHICAGO, Feb. 10, 1885.

Messrs. Giles, Bro. & Co.:

GENTLEMEN: I have now been carrying my watch encased in one of your Anti-Magnetic Shields for about a year, and it affords me pleasure to state to you that notwithstanding I have been very much about dynamo-electric machines during the time named, the anti-magnetic case seems to protect the watch perfectly from the magnetic influence of the machines. I have not made any special electrical tests, inasmuch as I regard the good running of the watch as all that is necessary. I am thoroughly convinced, from the effect upon my own watch, that the case is an excellent protection, and I may almost add an absolute preventive of magnetic influence from external sources to the delicate movements of a watch. My watch is a Howard watch, and during the period of two or three years previous to encasing it with your anti-magnetic case it had varied to a very great exent, and I had it demagnetized on two different occasions. I regard your case as a complete success, and if my indorsement of same is of any value, you are at liberty to use it.

Yours truly,

C. C. WARREN, *Manager Western Dept.,*
The U. S. Electric Lighting Co.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolts, cap and set screws, taps, dies, files, twist drills, brass and rubber in tubing, rod and sheet copper, brass, German silver steel and iron wire, shafting tools, etc.

STOCK QUOTATIONS.

The following list, compiled by Mr. W. H. Baker, member New York Stock Exchange, 16 and 18 Broad street, gives the current quotations of electrical stocks:

November 1, 1886.

TELEGRAPH.	Bid.	Asked.
Am. Dist.	.....	40
Am. Tel. & Cable	75	75½
Cen. & So. Am.	75	100
*Com. Tel.	.....	.....
*Gold & Stock	90	95
*Inter. Ocean Tel.	90	95
N. Y. Mutual	65	70
Pac. & Atl.	45	55
*Postal T. & C.	20	30
South. & Atl.	65	75
W. U. Tel.	79¼	79⅝
W. U. Scrip.	64	.....
W. U. Bonds.	123	.....
Mut. U. Bonds	84	85
TELEPHONE.		
Am. Bell	209	210
Am. Speaking	110	115
Erie	27½	.....
*Hudson River	.....	55

TELEPHONE.	Bid.	Asked.
Mexican	1½	.....
*N. Y. & N. J.	73	75
N. Y. & Pa.	.....	.....
New England	44½	.....
*Southern Bell	110	130
ELECTRIC LIGHT.		
*Am. Electric	.....	16
*Brush	.....	.....
*Brush Ill.	.....	.....
*Consolidated	.....	.....
*Daft	.....	100
*Edison	130	.....
*Edison Ill	90	100
*Edison Isolated	60	.....
*United States	42½	.....
*U. S. Ill.	85	100
MOTOR.		
*Daft	.....	.....
*Sprague	600	...

* These stocks are so seldom dealt in that it is difficult to give prices at which they can be bought or sold. The figures given are as near as can be ascertained.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

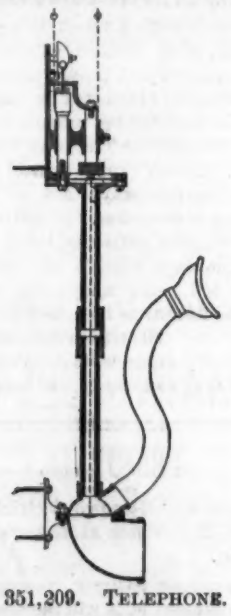
PATENTS DATED OCT. 19, 1886.

350,515. Underground Electric Cable; Benezette Williams, Chicago, Ill. The main object is to make a good joint between adjoining sections of concrete conduits for electrical conductors. (Dated Oct. 12.)

350,843. Machine for Manufacturing Insulator Pins for Telegraphic Purposes; Charles Rogers, Allegheny, Pa. Blocks of wood are taken up by the machine, taken to the cutter head, and shaped into pins. In traveling back each pin has a screw thread formed on one end. The machine also accomplishes other results besides those enumerated. (Dated Oct. 12.)

350,954. Regulator for Dynamo-Electric Machines; Nikola Tesla, Smiljan Lika, Austria, Hungary, Assignor to the Tesla Electric Light and Manufacturing Company, Rahway, N. J. Regulates by shifting the commutator brushes. An improvement on devices described in pending applications for patents.

(1) 350,955. Cut-out Apparatus for Electric Lamps; (2) 350,956. Automatic Compensator for Magnets; Elihu Thomson, New Britain, Conn., and Lynn, Mass., Assignor to the Thomson-Houston Electric Company, of Connecticut. (1) A conductor in a shunt circuit around an arc lamp is placed near the arc, so that, when the arc is abnormally lengthened, the current will flow across the space between the carbon electrode and the conductor. When this occurs a safety



351,209. TELEPHONE.

branch is automatically closed by electro-magnetic devices located in the shunt which includes the conductor. The branch may be closed by hand also. (See illustration.) (2) See page 227 of this issue.

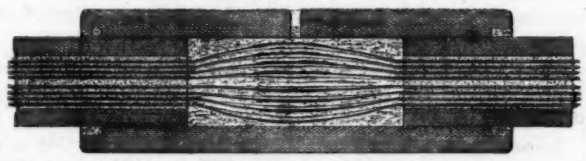
(1) 350,957. Electro-Magnet; (2) 350,958. Distribution of Electric Currents; Elihu Thomson, Lynn, Mass. (1) The object is to secure a practically uniform attraction in the different positions of the armature. (2) The invention is concerned broadly with providing efficient automatic means for switching in a resistance into a lamp circuit whenever a lamp is burnt out. Specifically, it has to do with the magnet by which the switching is effected. The principal object is to prevent vibration of the magnet's armature, and to secure a steady action, so as to render it insensible to quick or sudden variations in the exciting current, but sensible to permanent changes thereof.

350,975. Arc Lamp; Elisha B. Cutten, Pittsburgh, Pa., Assignor to the Electrical and Mechanical Developing Company, same place. The main and derived circuit solenoids are each provided with a clutch. The two clutches act reciprocally upon each other to prevent excessive movement of the upper carbon in either direction.

(1) 350,983. Printing Telegraph; (2) 350,984. Printing Telegraph; Jacob H. Linville, Philadelphia, Pa., Assignor to the International Printing Telegraph Company, Camden, N. J. (1) The objects are to print telegraphic messages, stock reports and other commercial matters with great rapidity and accuracy in page form on sheets or rolls of paper, in lines, paragraphs or columns, and to print such messages simultaneously at transmitter and receiver. The instruments employed can be used interchangeably as transmitter and receiver through the manipulation of a switch. (2) The general objects are the same as those of (1).

351,075. Fire-Alarm Apparatus; Eason L. Slocum, Pawtucket, R. I. In addition to the usual manual releasing devices for the signaling mechanism of a fire-alarm box, an electro-magnet is located in the box and so disposed with relation to the detent lever of the mechanism that its armature will remove the detents and allow the mechanism to rotate as soon as the condition of the magnet circuit is changed. The circuit of the magnet includes circuit changers located at various substations. The object is to provide means whereby an operator can actuate the signaling mechanism without going to the signal-box. (See illustration.)

351,077. Induction Coil; Franz Filipp Stögermayr, Vienna, Austria-Hungary, Assignor of one-half to Victor Glassner, same place. Three coils of insulated wire are wound

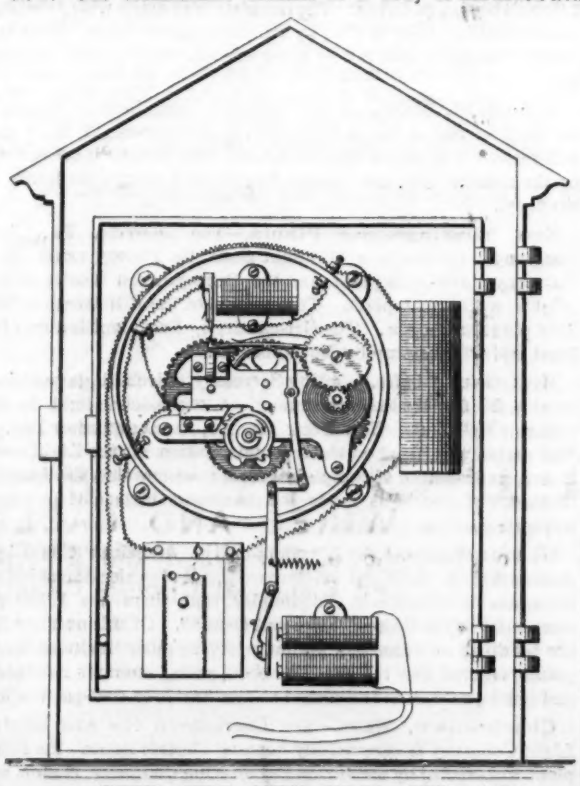


351,193. UNDERGROUND CONDUCTOR.

upon iron cores in the same axial line, so as to present poles of opposite name to one another. The two end coils are in circuit with a battery and a circuit-changer. The working circuit is that of the central coil, which has a commutator included in it for rectifying the induced currents. The coils are inclosed in cylinders of soft iron, wound with an insulated conducting wire, which branches off from the main circuit between the central coil and the commutator.

351,099. Annunciator; Charles H. Dowden, Newark, N. J. The device can be so arranged that the signaling discs will be withdrawn from view automatically, after having been exposed, or it can be arranged in the usual manner, requiring the discs to be restored by hand.

351,167. Commutator for Dynamo-Electric Machines and Electric Motors; Philip Diehl, Elizabeth, N. J. The commutator consists of a body of hardened non-



351,075. FIRE-ALARM APPARATUS.

conducting plastic material and metallic sections partly imbedded in the material, and held in place by it, thus dispensing with special fastening devices. The main objects are cheapness and durability.

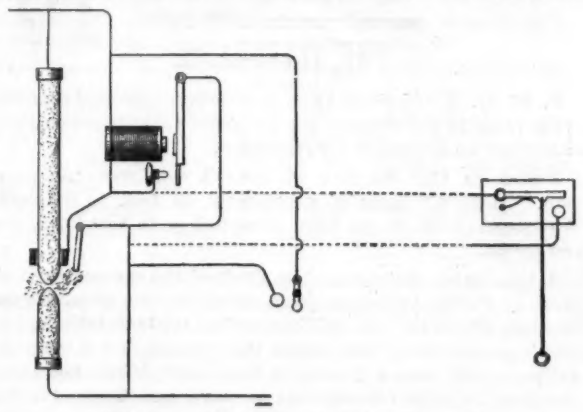
(1) 351,191. Electric Conductor; (2) 351,192. Machinery for Covering Electrical Conductors; (3) 351,193. Underground Electric Conductor; Edwin D. McCracken, Paterson, N. J. (1) The conductor is wound spirally with one or more lapping strips of paper, the latter being secured by a vulcanized adhesive substance. The wire may be first covered with a non-vulcanizable material. (2) Relates to a machine for making the above-described conductor. (3) Tube sections are laid with their adjacent ends separated some little distance, and connected by a coupling sleeve. The tube sections are made of spirally wound and superposed strips of vegetable paper. The sections of conductor within the tube section are also wound with strips of vegetable paper, and they are joined between the tube sections. A filling of insulating material insulates the conductors within the tube sections and the coupling sleeve. (See illustration.)

351,209. Telephone; Paul Seiler, San Fraacisco, Cal. A magneto telephone is provided with a second diaphragm, which is mechanically connected with the usual diaphragm by a wire or chain. The second diaphragm is the one spoken against in transmitting and the one to which the ear is put in receiving. The two diaphragms are located in the patented construction at the ends of a connecting tube. (See illustration.)

351,222. Electrical Time-piece; Swain Thackara, Camden, N. J. A secondary electric clock. The object is to enable it to be operated with little expenditure of battery power, and to so construct the clock that the hands can be set backward or forward with equal facility.

351,229. Electric Motor; Hugo Walter, Cincinnati, O. Two sets of rotating magnets are carried by a single shaft and arranged with the magnets of one set opposite the spaces between the magnets of the other set. Two sets of fixed magnets are arranged at right angles to the above and provided with necks or polar extensions so bent that the ends of the polar extensions are in close proximity to the polar extremities of the rotating magnets.

351,233. Electric Belt; Henry W. Watkins, Cleveland, O., Assignor to the Voltaic Electric Manufacturing Company. The first claim describes the construction: In an electric belt, the combination with a voltaic pile, a housing for said pile, said housing being made of non-conducting material, preferably of glass, and having lugs and depressed sides, of a metal plate,



350,955. CUT-OUT FOR ARC LAMPS.

preferably of zinc, said plate being folded to embrace the belt and fitting between the lugs of the housings, said plate having depressed sides to correspond with the depressed sides of the housings, the parts being arranged substantially as described.

351,239. Pendulum for Electric Clocks; John James Abell and Clarence Ben Gifford, Colesburg, Ky. The pendulum is impelled in one direction by the action of an electro-magnet, and in the opposite direction by the action of a tension spring. The invention is applicable to a clock or a clock system.

351,250. Telephone Transmitter; William R. Cole, Detroit, Mich., Assignor to himself, Frank G. Smith and George W. Moore, trustees, all of same place. The object of the invention is to obviate the frying and metallic sound common in telephonic transmission.

(1) 351,256. Electro-Magnet; (2) 351,257. Telephone Repeater; (3) 351,258. Telephone. Moses G. Farmer, New York, N. Y. (1) The magnet consists of two co-operating helices, each composed of two parts or coils, in combination with stationary sectional cores and a series of connected armatures movable therein. One of each pair of helices is a local coil and the other a main coil. (2) See page 226 of this issue. (3) Several armatures are rigidly connected to each other, and one of them is connected with a non-magnetic diaphragm. The armatures are in the same axial line and are held apart by brass rings. The structure thus built up forms the core of a local coil and of a main line outer coil surrounding the same.

351,310. Railroad Signal; J. Harper Gibson, New York, N. Y., Assignor to the American Railway Signal Company, of Illinois. May be operated by a train to signal its approach or by the moving of a switch to signal its position.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.